# Stained Soil Investigation Data Report and Evaluation Northwest Pipe Company, Portland Oregon

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#### 1.0 Introduction

CH2M HILL collected samples of subsurface soil and groundwater in and around the stained soil area north of the Lining and Coating building that was identified during soil excavation activities conducted in September 2011. The subsurface soil sampling and monitoring well installation occurred on May 31, 2012. The monitoring wells were developed by pumping and surging on June 1, 2012, with groundwater sampling on June 15, 2012.

This technical memorandum summarizes field activities, presents a summary of the laboratory data from the soil and groundwater sampling, evaluates the results, and presents CH2M HILL's recommendation for future work related to this matter.

Laboratory reports are included in Attachment 1.

#### 2.0 Field Activities

#### 2.1 Subsurface Soil Sampling

Subsurface soil samples were collected consistent with the DEQ-approved Work Plan (CH2M HILL 2012) and follow-up email communications between DEQ and the project team. One soil sample was collected from a depth coincident with the water table from five locations (GP301, GP302, GP303, GP304, and GP305) for a total of five discrete samples (See Figure 1). Direct-push sampling equipment operated by Cascade Drilling, Inc. of Clackamas, Oregon was driven in five-foot increments and a continuous soil core extracted for each increment. The soil cores were logged and inspected for visual and olfactory characteristics of contamination. Copies of the boring logs are provided in Attachment 2. A small aliquot was collected from each soil core for a soil vapor test using a hand-held photoionization detector and a visual sheen test.

Soil samples were collected for laboratory analysis from the portion of the core that straddled the water table observed at the time of sampling, as this depth was expected to contain the highest concentration of constituents due to the light, non-aqueous nature of residues associated with the coal tar demister that formerly operated in the area. Sample material was collected with a clean disposable stainless steel spoon and placed in a decontaminated stainless steel bowl to be homogenized. After the sample was thoroughly homogenized, the material was placed into

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laboratory supplied pre-labeled sample containers and placed in a pre-chilled cooler with ice. The soil samples were submitted under custody seal to the Applied Sciences Laboratory in Corvallis, Oregon for the following analyses:

- Total petroleum hydrocarbons (TPH) in the diesel and heavy oil fractions
- Extractable and volatile petroleum hydrocarbons (EPH/VPH, former demister location only)
- Polynuclear aromatic hydrocarbons (PAHs)
- Polychlorinated biphenyls (PCBs)
- Inorganic constituents (arsenic, cadmium, chromium, copper, lead, nickel, manganese, mercury, and zinc)
- Total organic carbon (TOC)

### 2.2 Groundwater Monitoring Well Installation and Sampling

Three monitoring wells were installed based on the results of the subsurface soil core field screening. The first well was installed in the area that was excavated during the removal of the stained soil. The second and third wells were installed approximately 10 feet beyond the location of the "stepped-out" subsurface soil sample locations (See Figure 1). The monitoring well borings were advanced using the direct push method. Once the target depth was reached, a monitoring well consisting of 2-inch nominal diameter polyvinyl chloride(PVC) well casing with a 10-foot 0.010-inch slot PVC screen with a pre-packed 10x20 Colorado Silica Sand filter pack was installed. The well was subsequently sealed with bentonite chips and finished with a flush-mounted locking cap placed in concrete. Well construction logs are located in Attachment 2. The wells were installed such that the screened interval straddled the water table observed at the time of well installation. Once the well construction was complete, the well seal was allowed to set overnight and the wells were developed the next day by pumping and surging. The top of the PVC casing at each well location subsequently was surveyed for use in calculating groundwater elevations. Table 1 summarizes well construction details.

Groundwater samples were collected on June 15, 2012 following the procedures identified in the Work Plan (CH2M HILL, 2012) and follow-up email communications between DEQ and the project team. Groundwater samples were collected using low flow sampling techniques. Once field parameters stabilized, groundwater was pumped into laboratory supplied pre-labeled sample containers and placed in a pre-chilled cooler with ice. The samples were submitted under custody seal to the Applied Sciences Laboratory in Corvallis, Oregon and analyzed for a similar list of constituents as noted above for soil samples, except EPH/VPH and TOC were not analyzed in groundwater.

#### 3.0 Results

### 3.1 Field Observations and Hydraulic Gradient

Table 2 summarizes groundwater elevation measured in site monitoring wells on June 15, 2012 and Figure 1 depicts the resulting potentiometric surface of the shallow fill aquifer. Water levels in mid-June were a few feet higher than observed during well installation because of the seasonal rise in Willamette River and Columbia River stages caused by reservoir regulation at Bonneville Dam on the Columbia. The hydraulic gradient for June 15, 2012 was to the west-northwest, with a magnitude of approximately 0.0013 ft/ft.

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Table 3 provides a summary of the field parameters observed at the end of purging just before samples were collected. These measurements indicate near-neutral groundwater pH, low specific conductance typical for shallow groundwater in the area, and geochemically reducing conditions, with oxidation-reduction potential (ORP) ranging from -100 millivolts (mV) to -134 mV, similar to that observed in the Southeast Area of the site. Because reducing conditions have been documented in both the stained soil area and the Southeast Area of the site, they may be attributed to the oxygen demand exerted by microbes decomposing natural organic matter incorporated in the dredged material used to fill the site and form the shallow fill aquifer as part of site original development.

#### 3.2 Analytical Results

The complete laboratory report for analytical results is contained in Attachment 1.

#### 3.2.1 Soil Results

Table 4 provides a summary of the laboratory results for the soil samples with comparison to background values (for inorganic constituents) and potentially relevant DEQ risk based concentrations (RBCs).

The concentrations for inorganic constituents were below published DEQ background values (DEQ 2010) and (for zinc) the Washington Department of Ecology background value for neighboring Clark County, Washington (Ecology 1994). Consequently, metals and inorganic constituent concentrations do not appear to have been affected by the operation of the former coal tar demister.

The other tested constituents (PAHs, PCBs, and petroleum hydrocarbons) were detected in one or more of the soil samples tested, with concentrations highest at the location of the former demister (GP302). Except for hydrocarbons at GP302, concentrations generally are low or below reporting limits.

The samples collected for this effort are deep (ranging in depth from 7 to 14 feet) and located in the middle of a large, heavy industrial area. Consequently, the only potentially relevant RBCs are based on occupational exposure for leaching to groundwater, the volatilization to outdoor air pathway, and volatilization to indoor air. By contrast, direct exposure RBCs (DEQ 2003) or screening levels based on potential erosion and transport to surface water (DEQ 2005) are not reasonably plausible exposure pathways.

As noted in Table 4, naphthalene in one sample at GP302 exceeded the RBC for leaching to groundwater, whereas the other four samples tested were well below the naphthalene leaching RBC. The potential for groundwater transport of naphthalene is evaluated later in this memorandum. None of the constituents exceeded the screening level for volatilization to outdoor air or indoor air.

The EPH and VPH results were evaluated using DEQ's risk-based decision making spreadsheet (DEQ 2003) for calculating site-specific RBCs for the particular mix of hydrocarbons observed in the stained soil area. Sample results for the most highly-concentrated sample (GP-302) were entered into the spreadsheet, which returned a value of ">MAX" for the leaching to groundwater pathway (Attachment 3). This correlates to an RBC of more than 100,000 milligrams per kilogram (DEQ 2003). Concentrations observed at the site are orders of magnitude below this level, indicating that EPH and VPH are well below levels of potential concern for the leaching to groundwater pathway.

#### 3.2.2 Groundwater Results

Table 5 presents the laboratory results for groundwater samples. Monitoring well 7 (MW-7), which was installed near the former demister location, had the highest concentration of PAHs and petroleum hydrocarbons, with MW-8 and MW-9 reflecting low to below-reporting-limit concentrations. PCBs were not detected in groundwater samples. Inorganic constituent concentrations were generally low or below reporting limits, except for manganese and arsenic. Both of these constituents are sensitive to ORP, with their solubility increasing as ORP becomes increasingly negative. The range of manganese concentrations is similar to that observed in the Southeast Area of the site during past sampling (CH2M HILL 2005), suggesting that the naturally reducing conditions found in the shallow fill aquifer may be causing naturally-occurring arsenic and manganese in the aquifer matrix to enter solution.

Because of the lack of reasonably likely drinking water exposure for the shallow aquifer, screening against tap water RBCs is inappropriate. Moreover, the location of the study area approximately 2,000 feet from the projected point of discharge to the Willamette River (based on the June 2012 hydraulic gradient) and the natural attenuation evaluation presented below in Section 3.3 indicates that screening values anticipating aquatic exposure or ingestion also are inappropriate for comparison. Consequently, Table 5 screens the groundwater results against RBCs based on occupational exposure for the volatilization pathway (outdoor air), vapor intrusion (indoor air), and potential exposure by excavation workers. As noted in Table 5, none of the concentrations exceeded potentially relevant screening levels.

#### 3.3 Natural Attenuation Evaluation

CH2M HILL completed a natural attenuation evaluation to investigate the potential for the concentrations of PAHs reported in groundwater near the former coal tar demister to migrate a substantial distance in the subsurface. The evaluation was conducted because PAHs have notably low solubility, tend to adsorb to organic carbon in the subsurface, are known to attenuate under both aerobic and anaerobic conditions, and consequently do not tend to form extensive plumes in groundwater except in unusual circumstances (such as manufactured gas plants or creosote wood treating operations) where large quantities of nonaqueous phase liquids are present in the subsurface).

The screening tool BIOSCREEN, version 1.4 (EPA 1997) was used to evaluate the potential mobility of acenaphthene, the PAH detected at the highest concentration in groundwater, as well as naphthalene, the PAH with the lowest organic carbon partition coefficient, the lowest retardation factor, and consequently the greatest potential for migration. Table 6 lists the basis for input parameters used in the analysis.

The output of both the base case and sensitivity runs are provided in Attachment 4 and are discussed below.

#### 3.3.1 Base Case Evaluation

The base case evaluation for both constituents indicates that natural attenuation via anaerobic degradation would be an important fate process for naphthalene and acenaphthene. Neither constituent was predicted to migrate above a concentration of 0.001 mg/L more than 30 feet under steady state conditions, far short of the 2000-foot flow path distance to the Willamette River. Despite the relatively slow anaerobic degradation rates (compared to faster aerobic rates), the relatively high organic carbon partition coefficients (Koc) associated with PAHs slow the migration of PAHs substantially, allowing even slow anaerobic degradation rates to become significant. This is

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consistent with the decision to focus the screening level comparisons in Section 3.2.2 on volatilization and excavation worker pathways.

#### 3.3.2 Sensitivity Evaluation

Three variables were adjusted to evaluate their potential to affect the conclusion reached under base case conditions. The following adjustments were made and evaluated using BIOSCREEN:

- The anaerobic degradation half life was raised by a factor of 10, simulating conditions under which degradation occurs at one-tenth the rate reported in the literature.
- The Koc was adjusted from the geometric mean to a value equal to the lowest value for each constituent cited by EPA (1996)
- The concentration in the source area was raised by a factor of 10, to provide a more potent source term and evaluate if higher concentrations substantially effect predicted outcomes

The results of these sensitivity runs are as follows:

- Adjusted half life: Using the midpoint of the distance range in which the constituent dropped below 0.001 mg/L as an estimate for migration distance, raising the degradation half life by a factor of 10 increased the migration distance by a factor of approximately 3 for acenaphthene and 3.6 for naphthalene; however, the maximum predicted migration distance under this scenario remained less than 100 feet.
- Adjusted Koc: Reducing the Koc value to the lowest value cited by EPA (1996) for each constituent had no calculated effect on acenaphthene migration, but increased the distance naphthalene is predicted to migrate until dropping below 0.001 mg/L by a factor of 1.4.
- **Adjusted concentration**: Raising the initial concentration by a factor of 10 had no calculated effect on the migration distance for either acenaphthene or naphthalene.

The results of the BIOSCREEN evaluation showed relatively little sensitivity to the adjustments used in the sensitivity analysis. Even raising the most sensitive variable evaluated (degradation half life) by an order of magnitude yielded a predicted migration distance prior to extinction below 0.001 mg/L more than 1,900 feet short of reaching the Willamette River. Based on this evaluation, the reported concentrations of PAHs in soil and groundwater would not pose an excess risk to potential receptors, including to the Willamette River.

#### 4.0 Recommendations

Because of the binary hydrologic conditions in the Portland area, with pronounced wet and dry seasons, CH2M HLL recommends a second sampling round for PAHs at the end of the dry season (October) to supplement the initial sampling round, which occurred in June at the end of the wet season. These data will be used to confirm the hydraulic gradient and concentrations observed in the June sampling. In the unlikely event these variables differ substantially from those already observed, the BIOSCREEN analysis will be repeated considering the new data.

Because of the limited potential for constituent migration in groundwater, the complications of attempting to install monitoring wells offsite, physical obstructions such as rail lines, active roadways, material storage areas, and structures, no additional monitoring wells to the west-northwest are proposed.

#### 5.0 References

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DEQ. 2003. Risk-Based Decision Making for the Remediation of Petroleum-Contaminated Sites. Oregon Department of Environmental Quality. September 22, 2003. Table updated June 7, 2012.

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Ecology. 1994. *Natural Background Soil Metals Concentrations in Washington State*. Washington Department of Ecology document 94-115. October 1994.

Smith, K. L. 2010. Anaerobic Degradation of Polycyclic Aromatic Hydrocarbons at a Creosote-Contaminated Superfund Site and the Significance of Increased Methane Production in an Organophilic Clay Sediment Cap. Doctoral dissertation in Environmental Sciences and Resources. Portland State University, Portland, Oregon.

## **Tables**

 Table 1

 Construction Summary of Groundwater Monitoring Wells

 Northwest Pipe Company Stained Soil Investigation

Well ID	Installation Date	Total Depth <sup>a</sup>	Casing Diameter (inches) <sup>b</sup>	Borehole Diameter (inches)	Screen Length (feet)	Screened Interval <sup>a</sup>	Top of Filter Pack <sup>a</sup>	MPE <sup>c</sup>	GSE <sup>d</sup>	Screened Material	Comments
MW-7	05/31/12	18	2-inch	4	10	17 to 7	6	26.37	26.79	Medium to fine sand	Installed with direct push
MW-8	05/31/12	17	2-inch	4	10	17 to 7	6	26.36	26.88	Medium to fine sand	Installed with direct push
MW-9	05/31/12	17	2-inch	4	10	17 to 7	6	25.75	26.17	Medium to fine sand	Installed with direct push

#### Notes:

Refer to Figure 1 for well locations.

<sup>&</sup>lt;sup>a</sup> Feet below ground surface (ft bgs).

<sup>&</sup>lt;sup>b</sup> Casing and screen constructed with flush-threaded Schedule 40 polyvinyl chloride with 0.010-inch machine-slotted screen.

<sup>&</sup>lt;sup>c</sup> MPE = Measuring point elevation, feet City of Portland Vertical Datum (COP).

<sup>&</sup>lt;sup>d</sup> GSE = Ground surface elevation, feet COP.

**Table 2**Groundwater Elevation Summary

Northwest Pipe Company Stained Soil Investigation

Well				Depth to	
ID	Date	Time	MPE <sup>a</sup>	Water <sup>b</sup>	Elevation <sup>c</sup>
MW-7	6/15/2012	15:18	26.37	5.98	20.39
MW-8	6/15/2012	14:22	26.36	6.00	20.36
MW-9	6/15/2012	13:17	25.75	5.35	20.40
Willamette River <sup>d</sup>	6/15/2012	14:30	0.175	9.44	9.27

#### Notes:

MPE = Measuring point elevation in feet City of Portland Vertical datum.
 MPE at north edge top of PVC well casing.

<sup>&</sup>lt;sup>b</sup> Depth to Water in feet below MPE.

<sup>&</sup>lt;sup>c</sup> Elevation in feet (MPE - depth to water)

<sup>&</sup>lt;sup>d</sup> Willamette River mean guage height (Morrison Street Bridge) converted from Willamette River datum by subtracting 0.175 foot from the measured value.

Table 3Field Observations, June 2012 Groundwater Sampling EventNorthwest Pipe Company

Well ID	Date Sampled	Sample Time	Purge Volume (gallons)	pH [-log (H+)]	Temperature (°Celsius)	Specific Conductance <sup>a</sup> (μS/cm at 25°C)	Turbidity (NTUs)	ORP <sup>b</sup> (millivolts)
MW-7	6/15/2012	15:18	1.5	6.7	14.4	353	11.4	-100
MW-8	6/15/2012	14:22	1.4	7.0	15.3	312	10.3	-134
MW-9	6/15/2012	13:17	2.3	6.8	15.9	360	2.8	-128

#### Notes:

 $\mu$ S/cm = micro Siemens per centimeter.

NTUs = nephelometric turbidity units.

 $<sup>^{\</sup>rm a}$  Specific conductance is electrical conductivity normalized to 25  $^{\rm o}{\rm C}.$ 

<sup>&</sup>lt;sup>b</sup> ORP = Oxidation reduction potential.

<sup>°</sup>C = degrees Celsius.

Table 4 Summary of Analytical Results for Soil Samples Northwest Pipe Company

Location ID							GP301	GP302	GP303	GP304	GP305	GP306	GP307
Sample ID						G	P301-10'-11'	GP302-7'-8'	GP303-9.5'-10.5'	GP304-9.5'-10.5'	GP305-9.5'-10.5'	GP306-10.5'-11.5'	GP307-13'-14'
Date Collected							31-May-12	31-May-12	31-May-12	31-May-12	31-May-12	31-May-12	31-May-12
Depth (feet)				2	2	2	10-11	7-8	9.5-10.5	9.5-10.5	9.5-10.5	10.5-11.5	13-14
			<sup>1</sup> DEQ Defalt	<sup>2</sup> DEQ Leaching to	<sup>2</sup> DEQ Volatilization	<sup>2</sup> DEQ Vapor Intrusion							
			Background	Groundwater	to Outdoor Air	into Buildings							
Chamical Casus/Chamical	040	l lmit	Inorganic	Occupational	Occupational	Occumentiamel Comments							
Chemical Group/Chemical General Chemistry	CAS	Unit	Chemicals	Scenario	Scenario	Occupational Scenario							
Total Organic Carbon	TOC	mg/kg				-		13,400				269	277
Metals	100	mg/ng						10,400				200	211
Lead	7439-92-1	mg/kg	17	30				1.76					
Manganese	7439-96-5	mg/kg	1500					149					
Mercury	7439-97-6	mg/kg	0.07					0.017					
Nickel	7440-02-0	mg/kg	38			-		11.7					
Arsenic	7440-38-2	mg/kg	7					2.52					
Cadmium	7440-43-9	mg/kg	1			-		0.15 J					
Chromium	7440-47-3	mg/kg	42			-		7.23					
Copper	7440-50-8	mg/kg	36					8.23					
Zinc	7440-66-6	mg/kg	86					26.8					
Polynuclear Aromatic Hydrocabons Anthracene	120-12-7	malka					0.179 J	209 J	0.00589	0.00219	0.00031 U		
Pyrene	129-00-0	mg/kg mg/kg				-	1.26 J	1,210 J	0.00369	0.0219	0.00262	<del></del>	
Benzo(g,h,i)perylene	191-24-2	mg/kg					0.184 J	4.17 UJ	0.0213	0.0201	0.00202 0.0008 J		 
Indeno(1,2,3-c,d)pyrene	193-39-5	mg/kg				_	0.207 J	4.17 UJ	0.00557	0.00116	0.00051 J		
Benzo(b)fluoroanthene	205-99-2	mg/kg				_	1.47 J	32.4 J	0.00748	0.00258	0.00083 J		
Fluoranthene	206-44-0	mg/kg			-	_	4.3 J	1,490 J	0.0232	0.016	0.00223		
Benzo(k)fluoranthene	207-08-9	mg/kg				-	0.483 J	15 J	0.00256	0.0008 J	0.00057 U		
Acenaphthylene	208-96-8	mg/kg				-	0.0422 J	14.1 J	0.00191	0.00039 J	0.00022 U		
Chrysene	218-01-9	mg/kg			-	-	0.938 J	115 J	0.00478	0.00212	0.00059 J		
Benzo(a)pyrene	50-32-8	mg/kg				-	0.917 J	17.5 J	0.005	0.00198	0.00062 J		
Dibenzo(a,h)anthracene	53-70-3	mg/kg			-	-	0.00827 UJ	3.83 UJ	0.00038 U	0.00039 U	0.00041 U		
Benzo(a)anthracene	56-55-3	mg/kg			-	-	0.598 J	164 J	0.00707	0.00356	0.00071 J		
Acenaphthene	83-32-9	mg/kg			-	-	0.817 J	904 J	0.00338	0.0065	0.0003 J		
Phenanthrene	85-01-8	mg/kg			-	-	0.119 J	1,160 J	0.0081	0.00542	0.00125		
Fluorene	86-73-7	mg/kg			-	-	0.324 J	324 J	0.00147	0.00118	0.00021 U		
1-Methylnaphthalene Naphthalene	90-12-0 91-20-3	mg/kg		 0.44	 99	 99	0.00417 UJ <b>0.00807 J</b>	13.3 J 7.41 J	0.00019 U <b>0.00048 J</b>	0.0002 U <b>0.00057 J</b>	0.00021 U 0.00021 U		
2-Methylnaphthalene	91-57-6	mg/kg mg/kg		0.44	99 		0.00446 UJ	7.41 J	0.00048 J 0.00021 U	0.00037 J 0.00021 U	0.00021 U		
	tal PAH <sup>3</sup>	ilig/kg		-	<del>-</del>	-	11.84627	5,687	0.10686	0.00021 0	0.01046		
Polychlorinated Biphenyls	IAI FAI I						11.04027	3,007	0.10000	0.07173	0.01040		
Aroclor-1260	11096-82-5	mg/kg		0.62		-	0.00156 U	0.0303 U	0.00802 J	0.00158 U	0.00163 U		
Aroclor-1254	11097-69-1	mg/kg		0.62	-	_	0.0862	0.507 J	0.00176 U	0.00182 U	0.00188 U		
Aroclor-1221	11104-28-2	mg/kg		0.62		-	0.0108 U	0.209 U	0.0106 U	0.0109 U	0.0113 U		
Aroclor-1232	11141-16-5	mg/kg		0.62	-	-	0.00052 U	0.0101 U	0.00051 U	0.00053 U	0.00054 U		
Aroclor-1248	12672-29-6	mg/kg		0.62	-	-	0.0014 U	0.0272 U	0.00137 U	0.00142 U	0.00146 U		
Aroclor-1016	12674-11-2	mg/kg		0.62		-	0.00519 U	0.1 U	0.00507 U	0.00524 U	0.0054 U		
Aroclor-1242	53469-21-9	mg/kg		0.62	-	-	0.00182 U	0.0352 U	0.00178 U	0.00183 U	0.00189 U		
	al PCBs <sup>3</sup>						0.0862	0.507	0.00802				
Total Petroleum Hydrocarbons:													
TPH-Diesel	TPH-Diesel	mg/kg			-	-	84.5	13,900 J	2.6 J	20 J	2.24 J		
TPH-Oil											6.53 J		
.,	TPH-Oil	mg/kg			-	-	92.2 J	2,650 J	7.52 J	40.7 J	0.00 0		
Volatile Petroleum Hydrocarbons	IPH-Oil				-								
C5-C6 Aliphatics	TPH-OII	mg/kg					2.5 U	3.6 U	7.52 J				
C5-C6 Aliphatics C6-C8 Aliphatics	I PH-Oil	mg/kg mg/kg			 	=	2.5 U 2.5 U	3.6 U <b>3.9 JD</b>					
C5-C6 Aliphatics C6-C8 Aliphatics C8-C10 Aliphatics	TPH-Oil	mg/kg mg/kg mg/kg				- - -	2.5 U 2.5 U 0.37 U	3.6 U 3.9 JD 1.2 JD					
C5-C6 Aliphatics C6-C8 Aliphatics C8-C10 Aliphatics C10-C12 Aliphatics	TPH-Oil	mg/kg mg/kg mg/kg mg/kg				= = = = = = = = = = = = = = = = = = = =	2.5 U 2.5 U 0.37 U 0.37 U	3.6 U 3.9 JD 1.2 JD 2.3 JD					
C5-C6 Aliphatics C6-C8 Aliphatics C8-C10 Aliphatics C10-C12 Aliphatics C8-C10 Aromatics	TPH-OII	mg/kg mg/kg mg/kg mg/kg mg/kg				- - -	2.5 U 2.5 U 0.37 U 0.37 U 2.5 U	3.6 U 3.9 JD 1.2 JD 2.3 JD 3.7 JD					
C5-C6 Aliphatics C6-C8 Aliphatics C8-C10 Aliphatics C10-C12 Aliphatics C8-C10 Aromatics C10-C12 Aromatics	TPH-OII	mg/kg mg/kg mg/kg mg/kg mg/kg mg/kg				= = = = = = = = = = = = = = = = = = = =	2.5 U 2.5 U 0.37 U 0.37 U 2.5 U 2.5 U	3.6 U 3.9 JD 1.2 JD 2.3 JD 3.7 JD 5.8 JD					
C5-C6 Aliphatics C6-C8 Aliphatics C8-C10 Aliphatics C10-C12 Aliphatics C8-C10 Aromatics	TPH-OII	mg/kg mg/kg mg/kg mg/kg mg/kg				= = = = = = = = = = = = = = = = = = = =	2.5 U 2.5 U 0.37 U 0.37 U 2.5 U	3.6 U 3.9 JD 1.2 JD 2.3 JD 3.7 JD					
C5-C6 Aliphatics C6-C8 Aliphatics C8-C10 Aliphatics C10-C12 Aliphatics C8-C10 Aromatics C10-C12 Aromatics C12-C13 Aromatics		mg/kg mg/kg mg/kg mg/kg mg/kg mg/kg			- - - - - -	-	2.5 U 2.5 U 0.37 U 0.37 U 2.5 U 2.5 U 2.5 U	3.6 U 3.9 JD 1.2 JD 2.3 JD 3.7 JD 5.8 JD 50 D	    	     	    		
C5-C6 Aliphatics C6-C8 Aliphatics C8-C10 Aliphatics C10-C12 Aliphatics C8-C10 Aromatics C10-C12 Aromatics C12-C13 Aromatics Total VPH		mg/kg mg/kg mg/kg mg/kg mg/kg mg/kg			- - - - - -	-	2.5 U 2.5 U 0.37 U 0.37 U 2.5 U 2.5 U 2.5 U	3.6 U 3.9 JD 1.2 JD 2.3 JD 3.7 JD 5.8 JD 50 D	    	     	    		
C5-C6 Aliphatics C6-C8 Aliphatics C8-C10 Aliphatics C10-C12 Aliphatics C8-C10 Aromatics C10-C12 Aromatics C12-C13 Aromatics Total VPH  Extractable Petroleum Hydrocarbons C12-C16 Aliphatics C12-C16 Aliphatics C12-C16 Aliphatics		mg/kg mg/kg mg/kg mg/kg mg/kg mg/kg mg/kg		     	- - - - - -	- - - - - -	2.5 U 2.5 U 0.37 U 0.37 U 2.5 U 2.5 U 2.5 U 2.5 U	3.6 U 3.9 JD 1.2 JD 2.3 JD 3.7 JD 5.8 JD 50 D 68 JD	     	     	     	     	
C5-C6 Aliphatics C6-C8 Aliphatics C8-C10 Aliphatics C10-C12 Aliphatics C8-C10 Aromatics C10-C12 Aromatics C12-C13 Aromatics Total VPH  Extractable Petroleum Hydrocarbons C10-C12 Aliphatics C12-C16 Aliphatics C16-C21 Aliphatics C16-C21 Aliphatics		mg/kg mg/kg mg/kg mg/kg mg/kg mg/kg mg/kg		     	- - - - - -		2.5 U 2.5 U 0.37 U 0.37 U 2.5 U 2.5 U 2.5 U 2.5 U 2.5 U 1.2 J	3.6 U 3.9 JD 1.2 JD 2.3 JD 3.7 JD 5.8 JD 50 D 68 JD 1.0 J 74 J 290 J	     	     	     	     	
C5-C6 Aliphatics C6-C8 Aliphatics C8-C10 Aliphatics C10-C12 Aliphatics C8-C10 Aromatics C10-C12 Aromatics C10-C12 Aromatics C12-C13 Aromatics Total VPH  Extractable Petroleum Hydrocarbons C10-C12 Aliphatics C12-C16 Aliphatics C16-C21 Aliphatics C16-C21 Aliphatics C16-C34 Aliphatics C21-C34 Aliphatics		mg/kg mg/kg mg/kg mg/kg mg/kg mg/kg mg/kg mg/kg		     	- - - - - - - -		2.5 U 2.5 U 0.37 U 0.37 U 2.5 U 2.5 U 2.5 U 2.5 U 2.5 U 2.5 U	3.6 U 3.9 JD 1.2 JD 2.3 JD 3.7 JD 5.8 JD 68 JD 1.0 J 74 J 290 J	     	     	     		
C5-C6 Aliphatics C6-C8 Aliphatics C8-C10 Aliphatics C10-C12 Aliphatics C8-C10 Aromatics C10-C12 Aromatics C12-C13 Aromatics Total VPH  Extractable Petroleum Hydrocarbons C10-C12 Aliphatics C12-C16 Aliphatics C12-C16 Aliphatics C16-C21 Aliphatics C21-C34 Aliphatics C11-C34 Aliphatics C11-C12 Aromatics		mg/kg		     	- - - - - - - -	- - - - - - - -	2.5 U 2.5 U 0.37 U 0.37 U 2.5 U 2.5 U 2.5 U 2.5 U 1.2 J 15 23 6.1 U	3.6 U 3.9 JD 1.2 JD 2.3 JD 3.7 JD 5.8 JD 50 D 68 JD 1.0 J 74 J 290 J 420 J 10 J	     	     	     		
C5-C6 Aliphatics C6-C8 Aliphatics C8-C10 Aliphatics C10-C12 Aliphatics C8-C10 Aromatics C10-C12 Aromatics C10-C12 Aromatics C10-C12 Aromatics C12-C13 Aromatics Total VPH  Extractable Petroleum Hydrocarbons C10-C12 Aliphatics C12-C16 Aliphatics C16-C21 Aliphatics C21-C34 Aliphatics C10-C12 Aromatics C10-C12 Aromatics C12-C16 Aromatics		mg/kg		     	- - - - - - - -	- - - - - - -	2.5 U 2.5 U 0.37 U 0.37 U 2.5 U 2.5 U 2.5 U 2.5 U 1.2 J 15 23 6.1 U 1.3 J	3.6 U 3.9 JD 1.2 JD 2.3 JD 3.7 JD 5.8 JD 50 D 68 JD 1.0 J 74 J 290 J 420 J 10 J 510 J	     	     	     		
C5-C6 Aliphatics C6-C8 Aliphatics C8-C10 Aliphatics C10-C12 Aliphatics C8-C10 Aromatics C10-C12 Aromatics C10-C12 Aromatics C12-C13 Aromatics Total VPH  Extractable Petroleum Hydrocarbons C10-C12 Aliphatics C12-C16 Aliphatics C16-C21 Aliphatics C21-C34 Aliphatics C11-C34 Aliphatics C11-C12 Aromatics		mg/kg		     	      	      	2.5 U 2.5 U 0.37 U 0.37 U 2.5 U 2.5 U 2.5 U 2.5 U 1.2 J 15 23 6.1 U	3.6 U 3.9 JD 1.2 JD 2.3 JD 3.7 JD 5.8 JD 50 D 68 JD 1.0 J 74 J 290 J 420 J 10 J	     	     	     		

mg/Kg = milligrams per kilogram
Bold result = detection
Shaded cell = screening criteria exceeded.
-- = no screening level available
J = Estimated value below reporting limit.
U = Not detected at specified reporting limit.
D = Value is from a dilution.

<sup>&</sup>lt;sup>1</sup> DEQ (2010) and Ecology (1996) <sup>2</sup> DEQ Risk Based Concentrations for soil - Occupational Scenario (June 2012).

<sup>&</sup>lt;sup>3</sup> Total PAHs and PCBs calculated using 0 for non-detects.

Table 5
Summary of Analytical Results for Groundwater Samples
Northwest Pipe Company

Location ID Sample ID							<b>MW-7</b> MW-7-61512	<b>MW-8</b> MW-8-61512	<b>MW-9</b> MW-9-61512
Date Collected							15-Jun-12	15-Jun-12	15-Jun-12
Sample Type							15-Juli-12 N	15-Juli-12 N	15-Juli-12 N
Запіріе Туре				<sup>1</sup> DEQ Volatilization to Outdoor Air	<sup>1</sup> DEQ Vapor Intrusion into Buildings	<sup>1</sup> DEQ Groundwater in Excavations	N	N	IN.
					Occupational				
Chemical Gro		CAS	Unit	Occupational Scenario	Scenario				
General Chem									
CONV	Total Suspended Solids (TSS)	TSS	mg/L				11.3	18.7	27
Metals									
METAL	Lead	7439-92-1	mg/L			<del></del>	0.00341 J	0.00146 U	0.00146 U
METAL	Manganese	7439-96-5	mg/L	<del></del>		3000	2.2	1.2	2.11
METAL	Mercury	7439-97-6	mg/L				0.000031 J	0.000029 J	0.000045 J
METAL	Nickel	7440-02-0	mg/L			12000	0.00948 J	0.0038 U	0.0038 U
METAL	Arsenic	7440-38-2	mg/L			5.8	0.00531	0.00154	0.00312
METAL	Cadmium	7440-43-9	mg/L			57	0.000076 J	0.000044 J	0.000042 J
METAL	Chromium	7440-47-3	mg/L			8.7	0.00073 U	0.00073 U	0.00073 U
METAL	Copper	7440-50-8	mg/L			5000	0.0033 J	0.00158 U	0.00158 U
METAL	Zinc	7440-66-6	mg/L				0.00704 J	0.00317 J	0.00264 J
Metals Dissolv									
		7439-92-1	mg/L				0.00419 J	0.00248 J	0.00302 J
METAL_DISS		7439-96-5	mg/L			3000	2.2	1.26	2.13
METAL_DISS	Mercury	7439-97-6	mg/L				0.000028 U	0.000098 J	0.000061 J
METAL_DISS	Nickel	7440-02-0	mg/L			12000	0.0101 J	0.0038 U	0.0038 U
METAL_DISS	Arsenic	7440-38-2	mg/L			5.8	0.00533	0.00144	0.00309
METAL_DISS	Cadmium	7440-43-9	mg/L			57	0.000073 J	0.000059 J	0.000062 J
METAL_DISS	Chromium	7440-47-3	mg/L			8.7	0.00075 J	0.00073 U	0.00073 U
METAL_DISS	Copper	7440-50-8	mg/L			5000	0.00158 U	0.00158 U	0.00158 U
METAL_DISS	Zinc	7440-66-6	mg/L				0.00581 J	0.00363 J	0.00396 J
Polynuclear A	romatic Hydrocabons								
PAH	Anthracene	120-12-7	mg/L				0.0452	0.00257	0.00019
PAH	Pyrene	129-00-0	mg/L				0.0736	0.00079 J	0.00018
PAH	Benzo(g,h,i)perylene	191-24-2	mg/L				0.00261 U	0.00024 U	0.000028 J
PAH	Indeno(1,2,3-c,d)pyrene	193-39-5	mg/L				0.00212 U	0.0002 U	0.000021 U
PAH	Benzo(b)fluoroanthene	205-99-2	mg/L				0.00334 U	0.00031 U	0.000033 U
PAH	Fluoranthene	206-44-0	mg/L				0.0975	0.00131	0.00017
PAH	Benzo(k)fluoranthene	207-08-9	mg/L	<del></del>			0.00378 U	0.00036 U	0.000037 U
PAH	Acenaphthylene	208-96-8	mg/L	<del></del>			0.0194	0.00306	0.000084 J
PAH	Chrysene	218-01-9	mg/L				0.00539 J	0.00025 U	0.000026 U
PAH	Benzo(a)pyrene	50-32-8	mg/L			0.00053	0.00283 U	0.00027 U	0.000028 U
PAH	Dibenzo(a,h)anthracene	53-70-3	mg/L	<u></u>		0.00021	0.00374 U	0.00035 U	0.000037 U
PAH	Benzo(a)anthracene	56-55-3	mg/L			0.0091	0.00896 J	0.0002 U	0.000021 U
PAH	Acenaphthene	83-32-9	mg/L				0.701	0.2	0.00665
PAH	Phenanthrene	85-01-8	mg/L				0.259	0.0176	0.00048
PAH	Fluorene	86-73-7	mg/L				0.171	0.0379	0.00046
PAH	1-Methylnaphthalene	90-12-0	mg/L			 	0.0392	0.014	0.00010 0.000051 J
PAH	Naphthalene	91-20-3	mg/L	16	10	0.5	0.0619	0.00042 U	0.000031 J
PAH	2-Methylnaphthalene	91-57-6	mg/L				0.0225	0.00042 U	0.000047 U
	Total PA		mg/L				1.50465	0.27723	0.00804
	Total PA	<u> </u>					1.30403	0.27723	0.00804

Table 5 Summary of Analytical Results for Groundwater Samples Northwest Pipe Company

Location I Sample ID Date Collect Sample Ty	cted						<b>MW-7</b> MW-7-61512 15-Jun-12 N	<b>MW-8</b> MW-8-61512 15-Jun-12 N	<b>MW-9</b> MW-9-61512 15-Jun-12 N
				<sup>1</sup> DEQ Volatilization to Outdoor Air	<sup>1</sup> DEQ Vapor Intrusion into Buildings	<sup>1</sup> DEQ Groundwater in Excavations			
					Occupational				
Chemical	Group/Chemical	CAS	Unit	Occupational Scenario	Scenario				
Polychlori	nated Biphenyls			•					
PCB	Aroclor-1260	11096-82-5	mg/L				0.0000062 U	0.0000062 U	0.000006 U
PCB	Aroclor-1254	11097-69-1	mg/L				0.0000075 U	0.0000075 U	0.0000073 U
PCB	Aroclor-1221	11104-28-2	mg/L				0.000017 U	0.000017 U	0.000017 U
PCB	Aroclor-1232	11141-16-5	mg/L				0.000017 U	0.000017 U	0.000016 U
PCB	Aroclor-1248	12672-29-6	mg/L				0.0000083 U	0.0000083 U	0.000008 U
PCB	Aroclor-1016	12674-11-2	mg/L				0.000015 U	0.000015 U	0.000015 U
PCB	Aroclor-1242	53469-21-9	mg/L				0.00002 U	0.00002 U	0.000019 U
		Total PCBs <sup>2</sup>					-	-	
Total Petro	oleum Hydrocarbons:								
TPH	TPH-Diesel	TPH-Diesel	mg/L				8.32	0.99	0.78
TPH	TPH-Oil	TPH-Oil	mg/L				1.21	0.22 J	0.55
Notes:									

mg/L = milligrams per liter Bold result = detection

-- = no screening level available

<sup>&</sup>lt;sup>1</sup> DEQ Risk Based Concentrations for Groundwater (June 2012).

<sup>&</sup>lt;sup>2</sup>Total PAHs and PCBs calculated using 0 for non-detects.

J = Estimated value below reporting limit.
U = Not detected at specified reporting limit.

 Table 6

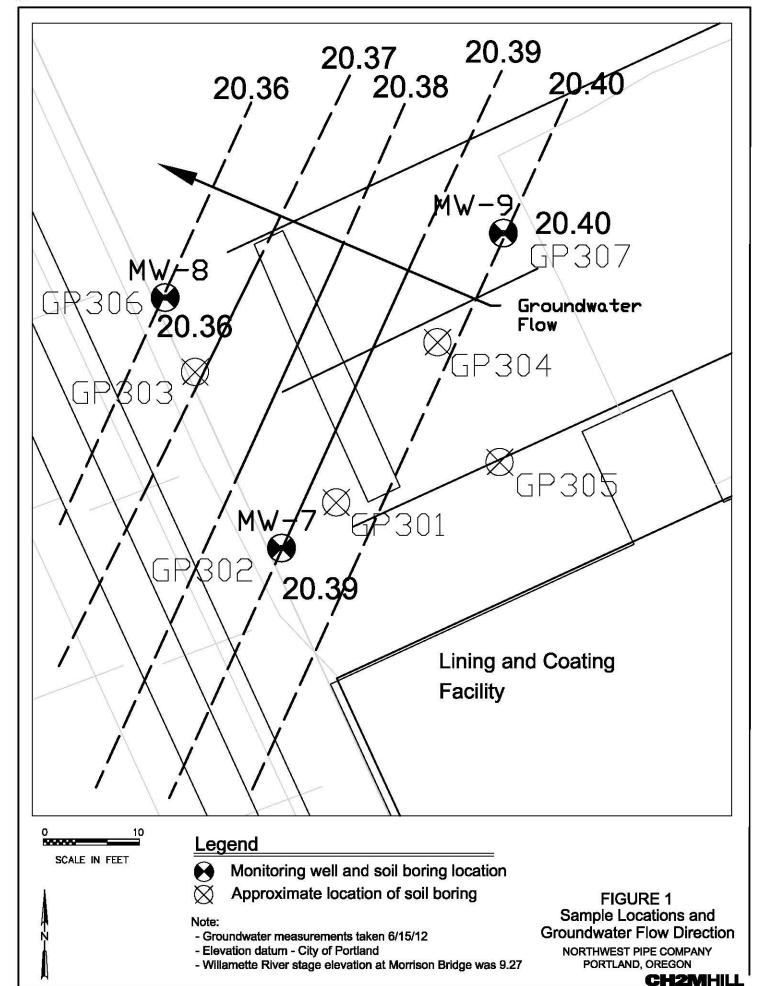
 BIOSCREEN Input Parameters

 Northwest Pipe Company Stained Soil Investigation

Input Parameter	Value Units	Comments
Hydraulic conductivity	0.01 cm/sec	Average of hydraulic conductivities for MW-7, MW-8, and MW-9 calculated from specific capacity data based on
		well purging, using the method described by Driscoll (1986)
Hydraulic gradient	0.0013 unitless	Gradient observed on June 13, 2012
Effective porosity	0.2 unitless	Typical default value
Seepage velocity	67 feet/year	Calculated from above values
Fraction organic carbon	0.0027 decimal %	Average of two aquifer samples collected ouside of the stained soil zone May 2012
Longitudinal dispersivity	11 feet	Recommended value from BIOSCREEN software for a 100-foot modeled area
Transverse dispersivity	1.1 feet	Recommended value from BIOSCREEN software for a 100-foot modeled area
Aquifer bulk density	1.7 kg/L	Typical default value
Acenphthene organic carbon partition coefficient (Koc)	4898 L/kg	Geometric mean value, EPA 1996
Naphthalene Koc	1191 L/kg	Geometric mean value, EPA 1996
Acenphthene source area concentration	0.701 mg/L	Highest concentration observed on June 13, 2012
Naphthalene source area concentration	0.0619 mg/L	Highest concentration observed on June 13, 2012
Source area width	20 feet	Assumed value based on field observation of stained soil
Source area depth	10 feet	Assumed value based on estimated saturated thickness
Acenaphthene anaerobic degradation half life	0.318 year	Chang et al. (2002)
Naphthalene anaerobic degradation half life	0.44 year	Smith (2010)
Sensitivity analysis - adjust half life of acenaphthene	3.18 year	Value 10 times base case (value is directly proportional to constituent potential to persist and migrate in the subsurface)
Sensitivity analysis - adjust half life of naphthalene	4.44 year	Value 10 times base case (value is directly proportional to constituent potential to persist and migrate in the subsurface)
Sensitivity analysis - adjust Koc for acenaphthene	3890 L/kg	Lowest cited value, EPA 1996 (value is inversely proportional to migrate rate)
Sensitivity analysis - adjust Koc for naphthalene	870 L/kg	Lowest cited value, EPA 1996 (value is inversely proportional to migrate rate)
Sensitivity analysis - adjust acenapthene concentration	7.01 mg/L	Value 10 times base case (value is directly proportional to constituent potential to persist and migrate in the subsurface)
Sensitivity analysis - adjust acenapthene concentration	0.619 mg/L	Value 10 times base case (value is directly proportional to constituent potential to persist and migrate in the subsurface)

subsurface)

## **Figure**



## **Attachment 1**

## **ANALYTICAL REPORT**

For:

**NW Pipe** 

ASL Report #: L1754

Project ID: 358932.TT.06.01

Attn: Pat Heins/PDX

cc:

Tina Rice/tina.rice@critigen.com

Authorized and Released By:

Laboratory Project Manager

Kothy Mckincey

Kathy McKinley

(541) 758-0235 ext.23144

June 27, 2012

This data package meets standards requested by client and is not intended or implied to meet any other standard.

All analyses performed by CH2M HILL are clearly indicated. Any subcontracted analyses are included as appended reports as received from the subcontracted laboratory. The results included in this report only relate to the samples listed on the following Sample Cross-Reference page. This report shall not be reproduced except in full, without the written approval of the laboratory.

Any unusual difficulties encountered during the analysis of your samples are discussed in the attached case narratives.

### **Sample Receipt Comments**

We certify that the test results meet all standard ASL requirements except those listed below:

Some analyses were performed by an outside laboratory and their report is attached.

### **Sample Cross-Reference**

ASL		Date/Time	Date
Sample ID	Client Sample ID	Collected	Received
L175401	GP301-10'-11'	05/31/12 09:30	06/01/12
L175402	GP302-7'-8'	05/31/12 10:00	06/01/12
L175403	GP303-9.5'-10.5'	05/31/12 10:30	06/01/12
L175404	GP304-9.5'-10.5'	05/31/12 11:00	06/01/12
L175405	GP305-9.5'-10.5'	05/31/12 11:30	06/01/12
L175406	GP306-10.5'-11.5'	05/31/12 13:45	06/01/12
L175407	GP307-13'-14'	05/31/12 15:30	06/01/12

#### CASE NARRATIVE GC/MS SEMI-VOLATILES ANALYSIS

Lab Name: CH2M HILL/LAB/CVO ASL SDG#: L1754 Project: **NW Pipe** Project #: 358932.TT.06.01 I. Method(s): Analysis: SW8270SIM Preparation: SW3550 II. Receipt/Holding Times: All acceptance criteria were met. III. Analysis: A. Initial Calibration(s): All acceptance criteria were met. B. Calibration Verification(s): All acceptance criteria were met. C. Blank(s): All acceptance criteria were met. D. **Laboratory Control Sample(s):** All acceptance criteria were met. E. Matrix Spike/Matrix Spike Duplicate Sample(s): Analyzed in accordance with standard operating procedure. F. Surrogate Standard(s): Surrogate Terphenyl-d14 in GP301-10'-11' was diluted out. Surrogate Terphenyl-d14 in GP302-7'-8' was diluted out. G. DFTPP Tune Verification(s): All acceptance criteria were met. H. Internal Standard(s): All acceptance criteria were met. I. Analytical Exception(s): None. IV. Documentation Exception(s): None. V. I certify that this data package is in compliance with the terms and conditions agreed to by the client and CH2M HILL, both technically and for completeness, except for the conditions detailed above. Release of the data contained in this hardcopy data package has been authorized by the Laboratory Manager or designee, as verified by the following signatures. Prepared by: Date:

Date:

Reviewed by:

**Client Information** 

Client Sample ID: GP301-10'-11'

Project Name: NW Pipe Sample Date: 05/31/12 Sample Time: 09:30

Type: Grab Matrix: Soil Basis: Dry Weight

Terphenyl-d14

**Lab Information** 

Lab Sample ID: L175401

Date Received: 06/01/12 Dilution Factor: 20

Report Revision No.: 0

				Sample			Analysis	Date
Analyte	CAS#	DL	RL	Result	Qualifier	Units	Method	Analyzed
GC/MS Semi-Volatiles								
Naphthalene	91-20-3	4.28	24.5	8.07	J	ug/Kg	SW8270SIM	06/14/12
2-Methylnaphthalene	91-57-6	4.46	24.5	4.46	U	ug/Kg	SW8270SIM	06/14/12
1-Methylnaphthalene	90-12-0	4.17	24.5	4.17	U	ug/Kg	SW8270SIM	06/14/12
Acenaphthylene	208-96-8	4.35	24.5	42.2		ug/Kg	SW8270SIM	06/14/12
Acenaphthene	83-32-9	3.78	24.5	817		ug/Kg	SW8270SIM	06/14/12
Fluorene	86-73-7	4.30	24.5	324		ug/Kg	SW8270SIM	06/14/12
Phenanthrene	85-01-8	4.57	24.5	119		ug/Kg	SW8270SIM	06/14/12
Anthracene	120-12-7	6.29	24.5	179		ug/Kg	SW8270SIM	06/14/12
Fluoranthene	206-44-0	4.37	24.5	4300		ug/Kg	SW8270SIM	06/14/12
Pyrene	129-00-0	3.60	24.5	1260		ug/Kg	SW8270SIM	06/14/12
Benzo(a)anthracene	56-55-3	3.68	24.5	598		ug/Kg	SW8270SIM	06/14/12
Chrysene	218-01-9	7.31	24.5	938		ug/Kg	SW8270SIM	06/14/12
Benzo(b)fluoroanthene	205-99-2	8.33	24.5	1470		ug/Kg	SW8270SIM	06/14/12
Benzo(k)fluoranthene	207-08-9	11.5	24.5	483		ug/Kg	SW8270SIM	06/14/12
Benzo(a)pyrene	50-32-8	5.70	24.5	917		ug/Kg	SW8270SIM	06/14/12
Indeno(1,2,3-c,d)pyrene	193-39-5	9.01	24.5	207		ug/Kg	SW8270SIM	06/14/12
Dibenzo(a,h)anthracene	53-70-3	8.27	24.5	8.27	U	ug/Kg	SW8270SIM	06/14/12
Benzo(g,h,i)perylene	191-24-2	9.01	24.5	184		ug/Kg	SW8270SIM	06/14/12
Surrog	aate	% R	ecovery	Contr	ol Limits	Qual	ifier	

0

18-137

U=Not detected at specified reporting limit J=Estimated value below reporting limit E=Estimated value above calibration range \*=See case narrative

**Client Information** 

Client Sample ID: GP302-7'-8'

Project Name: NW Pipe Sample Date: 05/31/12 Sample Time: 10:00 Type: Grab

Matrix: Soil
Basis: Dry Weight

Terphenyl-d14

**Lab Information** 

Lab Sample ID: L175402

Date Received: 06/01/12
Dilution Factor: 10000

Report Revision No.: 0

				Sample			Analysis	Date
Analyte	CAS#	DL	RL	Result	Qualifier	Units	Method	Analyzed
GC/MS Semi-Volatiles								
Naphthalene	91-20-3	1980	11300	7410	J	ug/Kg	SW8270SIM	06/15/12
2-Methylnaphthalene	91-57-6	2060	11300	11200	J	ug/Kg	SW8270SIM	06/15/12
1-Methylnaphthalene	90-12-0	1930	11300	13300		ug/Kg	SW8270SIM	06/15/12
Acenaphthylene	208-96-8	2010	11300	14100		ug/Kg	SW8270SIM	06/15/12
Acenaphthene	83-32-9	1750	11300	904000		ug/Kg	SW8270SIM	06/15/12
Fluorene	86-73-7	1990	11300	324000		ug/Kg	SW8270SIM	06/15/12
Phenanthrene	85-01-8	2120	11300	1160000		ug/Kg	SW8270SIM	06/15/12
Anthracene	120-12-7	2910	11300	209000		ug/Kg	SW8270SIM	06/15/12
Fluoranthene	206-44-0	2020	11300	1490000		ug/Kg	SW8270SIM	06/15/12
Pyrene	129-00-0	1670	11300	1210000		ug/Kg	SW8270SIM	06/15/12
Benzo(a)anthracene	56-55-3	1700	11300	164000		ug/Kg	SW8270SIM	06/15/12
Chrysene	218-01-9	3380	11300	115000		ug/Kg	SW8270SIM	06/15/12
Benzo(b)fluoroanthene	205-99-2	3860	11300	32400		ug/Kg	SW8270SIM	06/15/12
Benzo(k)fluoranthene	207-08-9	5340	11300	15000		ug/Kg	SW8270SIM	06/15/12
Benzo(a)pyrene	50-32-8	2640	11300	17500		ug/Kg	SW8270SIM	06/15/12
Indeno(1,2,3-c,d)pyrene	193-39-5	4170	11300	4170	U	ug/Kg	SW8270SIM	06/15/12
Dibenzo(a,h)anthracene	53-70-3	3830	11300	3830	U	ug/Kg	SW8270SIM	06/15/12
Benzo(g,h,i)perylene	191-24-2	4170	11300	4170	U	ug/Kg	SW8270SIM	06/15/12
Surrog	ate	% R	ecovery	Contr	ol Limits	Qual	ifier	

0

18-137

U=Not detected at specified reporting limit J=Estimated value below reporting limit E=Estimated value above calibration range

**Client Information** 

Client Sample ID: GP303-9.5'-10.5'

Project Name: NW Pipe Sample Date: 05/31/12 Sample Time: 10:30 Type: Grab

Matrix: Soil
Basis: Dry Weight

**Lab Information** 

Lab Sample ID: L175403

Date Received: 06/01/12

Qualifier

Dilution Factor: 1
Report Revision No.: 0

Sample **Analysis** Date CAS# DL RL Result Qualifier Units Method **Analyte Analyzed GC/MS Semi-Volatiles** ug/Kg SW8270SIM 06/20/12 Naphthalene 91-20-3 0.20 1.14 0.48 J U 2-Methylnaphthalene 91-57-6 0.21 1.14 0.21 ug/Kg **SW8270SIM** 06/20/12 1-Methylnaphthalene 90-12-0 0.19 1.14 0.19 U ug/Kg **SW8270SIM** 06/20/12 **SW8270SIM** 06/20/12 Acenaphthylene 208-96-8 0.20 1.14 1.91 ug/Kg 06/20/12 Acenaphthene 83-32-9 0.18 1.14 3.38 ug/Kg **SW8270SIM** Fluorene 86-73-7 0.20 1.14 1.47 ug/Kg **SW8270SIM** 06/20/12 Phenanthrene 85-01-8 0.21 1.14 8.10 ug/Kg **SW8270SIM** 06/20/12 0.29 **SW8270SIM** 06/20/12 120-12-7 1.14 5.89 ug/Kg Anthracene Fluoranthene 206-44-0 0.20 1.14 23.2 ug/Kg SW8270SIM 06/20/12 06/20/12 129-00-0 0.17 1.14 21.5 ug/Kg SW8270SIM Pyrene Benzo(a)anthracene 56-55-3 0.17 1.14 7.07 ug/Kg **SW8270SIM** 06/20/12 Chrysene 218-01-9 0.34 1.14 4.78 ug/Kg **SW8270SIM** 06/20/12 **SW8270SIM** 06/20/12 Benzo(b)fluoroanthene 205-99-2 0.39 1.14 7.48 ug/Kg 06/20/12 0.53 1.14 2.56 ug/Kg SW8270SIM Benzo(k)fluoranthene 207-08-9 Benzo(a)pyrene 50-32-8 0.26 1.14 5.00 ug/Kg **SW8270SIM** 06/20/12 06/20/12 193-39-5 0.42 1.14 5.57 ug/Kg **SW8270SIM** Indeno(1,2,3-c,d)pyrene U 06/20/12 0.38 ug/Kg **SW8270SIM** 53-70-3 0.38 1.14 Dibenzo(a,h)anthracene 191-24-2 0.42 1.14 8.47 ug/Kg SW8270SIM 06/20/12 Benzo(g,h,i)perylene

 Surrogate
 % Recovery
 Control Limits

 Terphenyl-d14
 87
 18-137

U=Not detected at specified reporting limit J=Estimated value below reporting limit

E=Estimated value above calibration range

<sup>\*=</sup>See case narrative

**Client Information** 

Client Sample ID: GP304-9.5'-10.5'

Project Name: NW Pipe Sample Date: 05/31/12 Sample Time: 11:00

Type: Grab Matrix: Soil Basis: Dry Weight

Terphenyl-d14

Lab Information

Lab Sample ID: L175404

Date Received: 06/01/12

Dilution Factor: 1

Report Revision No.: 0

				Sample			Analysis	Date
Analyte	CAS#	DL	RL	Result	Qualifier	Units	Method	Analyzed
GC/MS Semi-Volatiles								
Naphthalene	91-20-3	0.20	1.16	0.57	J	ug/Kg	SW8270SIM	06/15/12
2-Methylnaphthalene	91-57-6	0.21	1.16	0.21	U	ug/Kg	SW8270SIM	06/15/12
1-Methylnaphthalene	90-12-0	0.20	1.16	0.20	U	ug/Kg	SW8270SIM	06/15/12
Acenaphthylene	208-96-8	0.21	1.16	0.39	J	ug/Kg	SW8270SIM	06/15/12
Acenaphthene	83-32-9	0.18	1.16	6.50		ug/Kg	SW8270SIM	06/15/12
Fluorene	86-73-7	0.20	1.16	1.18		ug/Kg	SW8270SIM	06/15/12
Phenanthrene	85-01-8	0.22	1.16	5.42		ug/Kg	SW8270SIM	06/15/12
Anthracene	120-12-7	0.30	1.16	2.19		ug/Kg	SW8270SIM	06/15/12
Fluoranthene	206-44-0	0.21	1.16	16.0		ug/Kg	SW8270SIM	06/15/12
Pyrene	129-00-0	0.17	1.16	26.1		ug/Kg	SW8270SIM	06/15/12
Benzo(a)anthracene	56-55-3	0.17	1.16	3.56		ug/Kg	SW8270SIM	06/15/12
Chrysene	218-01-9	0.35	1.16	2.12		ug/Kg	SW8270SIM	06/15/12
Benzo(b)fluoroanthene	205-99-2	0.39	1.16	2.58		ug/Kg	SW8270SIM	06/15/12
Benzo(k)fluoranthene	207-08-9	0.55	1.16	0.80	J	ug/Kg	SW8270SIM	06/15/12
Benzo(a)pyrene	50-32-8	0.27	1.16	1.98		ug/Kg	SW8270SIM	06/15/12
Indeno(1,2,3-c,d)pyrene	193-39-5	0.43	1.16	1.16		ug/Kg	SW8270SIM	06/15/12
Dibenzo(a,h)anthracene	53-70-3	0.39	1.16	0.39	U	ug/Kg	SW8270SIM	06/15/12
Benzo(g,h,i)perylene	191-24-2	0.43	1.16	1.20		ug/Kg	SW8270SIM	06/15/12
Surrog	aate	% Re	ecovery	Contr	ol Limits	Qual	ifier	

101

18-137

U=Not detected at specified reporting limit J=Estimated value below reporting limit E=Estimated value above calibration range

**Client Information** 

Client Sample ID: GP305-9.5'-10.5'

Project Name: NW Pipe Sample Date: 05/31/12 Sample Time: 11:30

Type: Grab Matrix: Soil Basis: Dry Weight **Lab Information** 

Lab Sample ID: L175405

Date Received: 06/01/12

Dilution Factor: 1

Report Revision No.: 0

				Sample			Analysis	Date
Analyte	CAS#	DL	RL	Result	Qualifier_	Units	Method	Analyzed
GC/MS Semi-Volatiles								
Naphthalene	91-20-3	0.21	1.22	0.21	U	ug/Kg	SW8270SIM	06/20/12
2-Methylnaphthalene	91-57 <b>-</b> 6	0.22	1.22	0.22	U	ug/Kg	SW8270SIM	06/20/12
1-Methylnaphthalene	90-12-0	0.21	1.22	0.21	U	ug/Kg	SW8270SIM	06/20/12
Acenaphthylene	208-96-8	0.22	1.22	0.22	U	ug/Kg	SW8270SIM	06/20/12
Acenaphthene	83-32-9	0.19	1.22	0.30	J	ug/Kg	SW8270SIM	06/20/12
Fluorene	86-73-7	0.21	1.22	0.21	U	ug/Kg	SW8270SIM	06/20/12
Phenanthrene	85-01-8	0.23	1.22	1.25		ug/Kg	SW8270SIM	06/20/12
Anthracene	120-12-7	0.31	1.22	0.31	U	ug/Kg	SW8270SIM	06/20/12
Fluoranthene	206-44-0	0.22	1.22	2.23		ug/Kg	SW8270SIM	06/20/12
Pyrene	129-00-0	0.18	1.22	2.62		ug/Kg	SW8270SIM	06/20/12
Benzo(a)anthracene	56-55-3	0.18	1.22	0.71	J	ug/Kg	SW8270SIM	06/20/12
Chrysene	218-01-9	0.36	1.22	0.59	J	ug/Kg	SW8270SIM	06/20/12
Benzo(b)fluoroanthene	205-99-2	0.41	1.22	0.83	J	ug/Kg	SW8270SIM	06/20/12
Benzo(k)fluoranthene	207-08-9	0.57	1.22	0.57	U	ug/Kg	SW8270SIM	06/20/12
Benzo(a)pyrene	50-32-8	0.28	1.22	0.62	J	ug/Kg	SW8270SIM	06/20/12
Indeno(1,2,3-c,d)pyrene	193-39-5	0.45	1.22	0.51	J	ug/Kg	SW8270SIM	06/20/12
Dibenzo(a,h)anthracene	53-70-3	0.41	1.22	0.41	Ū	ug/Kg	SW8270SIM	06/20/12
Benzo(g,h,i)perylene	191-24-2	0.45	1.22	0.80	<b>J</b> .	ug/Kg	SW8270SIM	06/20/12

Surrogate% RecoveryControl LimitsQualifierTerphenyl-d148918-137

U=Not detected at specified reporting limit J=Estimated value below reporting limit E=Estimated value above calibration range

**Client Information** 

Client Sample ID: SB2-0607

Project Name: NW Pipe Sample Date: N/A Sample Time: N/A

Type: QC Matrix: Soil Basis: Dry Weight **Lab Information** 

Lab Sample ID: SB2-0607

Date Received: N/A
Dilution Factor: 1
Report Revision No.: 0

Sample **Analysis Date** CAS# DL RL Result Qualifier **Analyte** Units Method **Analyzed** GC/MS Semi-Volatiles Naphthalene 91-20-3 0.17 1.00 0.17 U ug/Kg **SW8270SIM** 06/13/12 2-Methylnaphthalene 91-57-6 0.18 1.00 0.18 U ug/Kg **SW8270SIM** 06/13/12 1-Methylnaphthalene 90-12-0 0.17 1.00 0.17 U ug/Kg SW8270SIM 06/13/12 Acenaphthylene 208-96-8 0.18 1.00 0.18 U **SW8270SIM** 06/13/12 ug/Kg Acenaphthene 83-32-9 0.15 1.00 0.15 U ug/Kg **SW8270SIM** 06/13/12 86-73-7 1.00 U **SW8270SIM** 06/13/12 Fluorene 0.18 0.18 ug/Kg 85-01-8 1.00 0.19 U ug/Kg 06/13/12 Phenanthrene 0.19 SW8270SIM 0.26 1.00 0.26 06/13/12 Anthracene 120-12-7 U ug/Kg SW8270SIM 0.18 1.00 0.18 U 06/13/12 Fluoranthene 206-44-0 ug/Kg SW8270SIM 1.00 0.15 U Pyrene 129-00-0 0.15 ug/Kg SW8270SIM 06/13/12 Benzo(a)anthracene 56-55-3 0.15 1.00 0.15 U ug/Kg **SW8270SIM** 06/13/12 0.30 1.00 0.30 U SW8270SIM 06/13/12 Chrysene 218-01-9 ug/Kg 1.00 0.34 U 205-99-2 0.34 ug/Kg SW8270SIM 06/13/12 Benzo(b)fluoroanthene Benzo(k)fluoranthene 207-08-9 0.47 1.00 0.47 U ug/Kg SW8270SIM 06/13/12 1.00 0.23 06/13/12 Benzo(a)pyrene 50-32-8 0.23 U ug/Kg SW8270SIM 0.37 1.00 193-39-5 0.37 U ug/Kg SW8270SIM 06/13/12 Indeno(1,2,3-c,d)pyrene Dibenzo(a,h)anthracene 53-70-3 0.34 1.00 0.34 U ug/Kg **SW8270SIM** 06/13/12 0.37 0.37 U **SW8270SIM** 06/13/12 Benzo(g,h,i)perylene 191-24-2 1.00 ug/Kg

Surrogate% RecoveryControl LimitsQualifierTerphenyl-d149018-137

U=Not detected at specified reporting limit J=Estimated value below reporting limit E=Estimated value above calibration range

**Client Information** 

Client Sample ID: BS2S0607

Project Name: NW Pipe

Type: QC Matrix: Soil **Lab Information** 

Lab Sample ID: BS2S0607

Dilution Factor: 1
Report Revision No.: 0

Analyte	CAS#	Spike Amount	Sample Result	Units	%Recovery	Analysis Method	Date Analyzed
GC/MS Semi-Volatiles							
Naphthalene	91-20-3	50.0	43.3	ug/Kg	87	SW8270SIM	06/13/12
2-Methylnaphthalene	91-57-6	50.0	40.9	ug/Kg	82	SW8270SIM	06/13/12
1-Methylnaphthalene	90-12-0	50.0	38.2	ug/Kg	76	SW8270SIM	06/13/12
Acenaphthylene	208-96-8	50.0	46.7	ug/Kg	93	SW8270SIM	06/13/12
Acenaphthene	83-32-9	50.0	40.4	ug/Kg	81	SW8270SIM	06/13/12
Fluorene	86-73-7	50.0	44.0	ug/Kg	88	SW8270SIM	06/13/12
Phenanthrene	85-01-8	50.0	44.6	ug/Kg	89	SW8270SIM	06/13/12
Anthracene	120-12-7	50.0	40.0	ug/Kg	80	SW8270SIM	06/13/12
Fluoranthene	206-44-0	50.0	45.3	ug/Kg	91	SW8270SIM	06/13/12
Pyrene	129-00-0	50.0	45.7	ug/Kg	91	SW8270SIM	06/13/12
Benzo(a)anthracene	56-55-3	50.0	49.5	ug/Kg	99	SW8270SIM	06/13/12
Chrysene	218-01-9	50.0	43.8	ug/Kg	88	SW8270SIM	06/13/12
Benzo(b)fluoroanthene	205-99-2	50.0	44.4	ug/Kg	89	SW8270SIM	06/13/12
Benzo(k)fluoranthene	207-08-9	50.0	41.6	ug/Kg	83	SW8270SIM	06/13/12
Benzo(a)pyrene	50-32-8	50.0	38.1	ug/Kg	76	SW8270SIM	06/13/12
Indeno(1,2,3-c,d)pyrene	193-39-5	50.0	42.5	ug/Kg	85	SW8270SIM	06/13/12
Dibenzo(a,h)anthracene	53-70-3	50.0	43.1	ug/Kg	86	SW8270SIM	06/13/12
Benzo(g,h,i)perylene	191-24-2	50.0	40.9	ug/Kg	82	SW8270SIM	06/13/12
Surrog	gate	% Red	covery	Control Limits	Qualif	fier	

Surrogate % Recovery Control Limits
Terphenyl-d14 92 18-137

U=Not detected at specified reporting limit J=Estimated value below reporting limit E=Estimated value above calibration range

## CASE NARRATIVE PCB AROCLORS ANALYSIS

Lab Nan	ne: <u>C</u>	H2M HILL/LAB/CVO	ASL SDG#	: <u>L1754</u>	
Project:	<u>NW</u>	<u>Pipe</u>	Project #:	358932.T	T.06.01
I.	•	d(s): sis: SW8082 ration: SW3550			
II.	-	ot/Holding Times: ceptance criteria were met.			
III.	Analys	sis:			
	A.	Initial Calibration(s): All acceptance criteria were met.			
	B.	<u>Calibration Verification(s):</u> All acceptance criteria were met.			
	C.	Blank(s): All acceptance criteria were met.			
	D.	<u>Laboratory Control Sample(s):</u> All acceptance criteria were met.			
	E.	Matrix Spike/Matrix Spike Duplicate Sa Analyzed in accordance with standard o		edure.	
	F.	Surrogate Standard(s): Surrogate DCBP in GP302-7'-8' was dil	uted out.		
	G.	Analytical Exception(s): None.			
IV.	Docum None.	nentation Exception(s):			
V.	CH2M the da	fy that this data package is in compliance we is that this data package is in compliance we is the sound in this hardcopy data package ee, as verified by the following signatures.	ess, except for	r the conditi	ons detailed above. Release of
Prepared	d by:	C. Hopper		Date:	6/14/12
Reviewe	ed by:	- Deleathing		Date:	

11141-16-5

53469-21-9

12672-29-6

11097-69-1

**Client Information** 

Analyte

Aroclor-1016

Aroclor-1260

Aroclor-1221

Aroclor-1232

Aroclor-1242

Aroclor-1248

Aroclor-1254

**GC Semi-Volatiles** 

Client Sample ID: GP301-10'-11'

Project Name: NW Pipe Sample Date: 05/31/12 Sample Time: 09:30

> Type: Grab Matrix: Soil Basis: Dry Weight

Lab Information

Lab Sample ID: L175401

Date Received: 06/01/12

SW8082

SW8082

SW8082

SW8082

06/14/12

06/14/12

06/14/12

06/14/12

Dilution Factor: 1
Report Revision No.: 0

ug/Kg

ug/Kg

ug/Kg

ug/Kg

Sample **Analysis** Date Result CAS# DL RL Qualifier Units Method Analyzed ug/Kg SW8082 12674-11-2 5.19 28.9 5.19 U 06/14/12 28.9 SW8082 11096-82-5 1.56 1.56 U ug/Kg 06/14/12 11104-28-2 10.8 28.9 10.8 U ug/Kg SW8082 06/14/12

0.52

1.82

1.40

86.2

U

U

U

28.9

28.9

28.9

28.9

Surrogate% RecoveryControl LimitsQualifierDCBP8325-143

0.52

1.82

1.40

1.80

U=Not detected at specified reporting limit J=Estimated value below reporting limit E=Estimated value above calibration range

**Client Information** 

Client Sample ID: GP302-7'-8'

Project Name: NW Pipe Sample Date: 05/31/12 Sample Time: 10:00

Type: Grab Matrix: Soil Basis: Dry Weight

**DCBP** 

**Lab Information** 

Lab Sample ID: L175402

Date Received: 06/01/12
Dilution Factor: 20

Report Revision No.: 0

				Sample			Analysis	Date
Analyte	CAS#	DL	RL	Result	Qualifier	Units	Method	Analyzed
GC Semi-Volatiles				_				
Aroclor-1016	12674-11-2	100	559	100	U	ug/Kg	SW8082	06/14/12
Aroclor-1260	11096-82-5	30.3	559	30.3	U	ug/Kg	SW8082	06/14/12
Aroclor-1221	11104-28-2	209	559	209	U	ug/Kg	SW8082	06/14/12
Aroclor-1232	11141-16-5	10.1	559	10.1	U	ug/Kg	SW8082	06/14/12
Aroclor-1242	53469-21-9	35.2	559	35.2	U	ug/Kg	SW8082	06/14/12
Aroclor-1248	12672-29-6	27.2	559	27.2	U	ug/Kg	SW8082	06/14/12
Aroclor-1254	11097-69-1	34.9	559	507	J	ug/Kg	SW8082	06/14/12
Su	rrogate	% Re	ecovery	Contr	ol Limits	Quali	fier	

0

25-143

U=Not detected at specified reporting limit J=Estimated value below reporting limit E=Estimated value above calibration range

**Client Information** 

Client Sample ID: GP303-9.5'-10.5'

Project Name: NW Pipe Sample Date: 05/31/12 Sample Time: 10:30

DCBP

Type: Grab Matrix: Soil Basis: Dry Weight **Lab Information** 

Lab Sample ID: L175403

Date Received: 06/01/12

Dilution Factor: 1
Report Revision No.: 0

				Sample			Analysis	Date
Analyte	CAS#	DL	RL	Result	Qualifier	Units	Method	Analyzed
GC Semi-Volatiles		_					•	
Aroclor-1016	12674-11-2	5.07	28.2	5.07	U	ug/Kg	SW8082	06/14/12
Aroclor-1260	11096-82-5	1.53	28.2	8.02	J	ug/Kg	SW8082	06/14/12
Aroclor-1221	11104-28-2	10.6	28.2	10.6	U	ug/Kg	SW8082	06/14/12
Aroclor-1232	11141-16-5	0.51	28.2	0.51	U	ug/Kg	SW8082	06/14/12
Aroclor-1242	53469-21-9	1.78	28.2	1.78	U	ug/Kg	SW8082	06/14/12
Aroclor-1248	12672-29-6	1.37	28.2	1.37	U	ug/Kg	SW8082	06/14/12
Aroclor-1254	11097-69-1	1.76	28.2	1.76	U	ug/Kg	SW8082	06/14/12
Su	rrogate	% Re	ecovery	Contr	ol Limits	Quali	fier	

88

25-143

U=Not detected at specified reporting limit J=Estimated value below reporting limit E=Estimated value above calibration range

**Client Information** 

Client Sample ID: GP304-9.5'-10.5'

Project Name: NW Pipe Sample Date: 05/31/12 Sample Time: 11:00 Type: Grab

Matrix: Soil
Basis: Dry Weight

**Lab Information** 

Lab Sample ID: L175404

Date Received: 06/01/12

Dilution Factor: 1

Report Revision No.: 0

				Sample			Analysis	Date
Analyte	CAS#	DL	RL	Result	Qualifier	Units	Method	Analyzed
GC Semi-Volatiles								<u>—</u>
Aroclor-1016	12674-11-2	5.24	29.2	5.24	U	ug/Kg	SW8082	06/14/12
Aroclor-1260	11096-82-5	1.58	29.2	1.58	U	ug/Kg	SW8082	06/14/12
Aroclor-1221	11104-28-2	10.9	29.2	10.9	U	ug/Kg	SW8082	06/14/12
Aroclor-1232	11141-16-5	0.53	29.2	0.53	U	ug/Kg	SW8082	06/14/12
Aroclor-1242	53469-21-9	1.83	29.2	1.83	U	ug/Kg	SW8082	06/14/12
Aroclor-1248	12672-29-6	1.42	29.2	1.42	U	ug/Kg	SW8082	06/14/12
Aroclor-1254	11097-69-1	1.82	29.2	1.82	U	ug/Kg	SW8082	06/14/12

Surrogate% RecoveryControl LimitsQualifierDCBP8925-143

U=Not detected at specified reporting limit J=Estimated value below reporting limit E=Estimated value above calibration range \*=See case narrative

**Client Information** 

Client Sample ID: GP305-9.5'-10.5'

Project Name: NW Pipe Sample Date: 05/31/12 Sample Time: 11:30

> Type: Grab Matrix: Soil Basis: Dry Weight

> > **DCBP**

**Lab Information** 

Lab Sample ID: L175405

Date Received: 06/01/12

Dilution Factor: 1

Report Revision No.: 0

				Sample			Analysis	Date
Analyte	CAS#	DL	RL	Result	Qualifier	Units	Method	Analyzed
GC Semi-Volatiles								
Aroclor-1016	12674-11-2	5.40	30.1	5.40	U	ug/Kg	SW8082	06/14/12
Aroclor-1260	11096-82-5	1.63	30.1	1.63	U	ug/Kg	SW8082	06/14/12
Aroclor-1221	11104-28-2	11.3	30.1	11.3	U	ug/Kg	SW8082	06/14/12
Aroclor-1232	11141-16-5	0.54	30.1	0.54	U	ug/Kg	SW8082	06/14/12
Aroclor-1242	53469-21-9	1.89	30.1	1.89	U	ug/Kg	SW8082	06/14/12
Aroclor-1248	12672-29-6	1.46	30.1	1.46	U	ug/Kg	SW8082	06/14/12
Aroclor-1254	11097-69-1	1.88	30.1	1.88	U	ug/Kg	SW8082	06/14/12
Su	ırrogate	% R	ecovery	Contr	ol Limits	Qualit	fier	

85

25-143

U=Not detected at specified reporting limit J=Estimated value below reporting limit E=Estimated value above calibration range \*=See case narrative

**Client Information** 

Client Sample ID: SB1-0607

Project Name: NW Pipe Sample Date: N/A Sample Time: N/A Type: QC

Matrix: Soil
Basis: Dry Weight

**Lab Information** 

Lab Sample ID: SB1-0607

Qualifier

Date Received: N/A
Dilution Factor: 1
Report Revision No.: 0

		Analysis	Date					
Analyte	CAS#	DL	L RL	Result	Qualifier	Units	Method	Analyzed
GC Semi-Volatiles								
Aroclor-1016	12674-11-2	4.49	25.0	4.49	U	ug/Kg	SW8082	06/13/12
Aroclor-1260	11096-82-5	1.35	25.0	1.35	U	ug/Kg	SW8082	06/13/12
Aroclor-1221	11104-28-2	9.36	25.0	9.36	U	ug/Kg	SW8082	06/13/12
Aroclor-1232	11141-16-5	0.45	25.0	0.45	U	ug/Kg	SW8082	06/13/12
Aroclor-1242	53469-21-9	1.57	25.0	1.57	U	ug/Kg	SW8082	06/13/12
Aroclor-1248	12672-29-6	1.22	25.0	1.22	U	ug/Kg	SW8082	06/13/12
Aroclor-1254	11097-69-1	1.56	25.0	1.56	U	ug/Kg	SW8082	06/13/12

Surrogate% RecoveryControl LimitsDCBP8725-143

U=Not detected at specified reporting limit J=Estimated value below reporting limit E=Estimated value above calibration range

**Client Information** 

Client Sample ID: BS1S0607

Project Name: NW Pipe

Type: QC Matrix: Soil **Lab Information** 

Lab Sample ID: BS1S0607

Dilution Factor: 1
Report Revision No.: 0

Analyte	CAS#	Spike Amount	Sample Result	Units	%Recovery	Analysis Method	Date Analyzed
GC Semi-Volatiles							
Aroclor-1016	12674-11-2	125	108	ug/Kg	86	SW8082	06/13/12
Aroclor-1260	11096-82-5	125	119	ug/Kg	95	SW8082	06/13/12
S	Surrogate	% Red	covery	Control Limits	Qualifi	er	
DCBP		9	0	25-143			

### CASE NARRATIVE GC SEMI-VOLATILES ANALYSIS

Lab Nar	ne: <u>CF</u>	<u>12M HILL/LAB/CVO</u>	ASL SDG#	: <u>L1754</u>	
Project:	<u>NW F</u>	<u>Pipe</u>	Project #:	358932.T	T.06.01
I.	-	(s): s: NWTPH-DX tion: SW3550			
II.	•	/Holding Times: eptance criteria were met.			
III.	Analysi	<u>s:</u>			
	A.	Initial Calibration(s): All acceptance criteria were met.			
	В.	Calibration Verification(s): All acceptance criteria were met.			
	C.	Blank(s): All acceptance criteria were met.			
	D.	<u>Laboratory Control Sample(s):</u> All acceptance criteria were met.			
	E.	Matrix Spike/Matrix Spike Duplicate Sam Analyzed in accordance with standard open		dure.	
	F.	Surrogate Standard(s): Surrogate o-Terphenyl in GP302-7'-8' was diluted out.	s diluted out.	Surrogate	Octacosane in GP302-7'-8'
	G.	Analytical Exception(s): None.			
IV.	Docume None.	entation Exception(s):			
V.	CH2M the data	that this data package is in compliance wit HILL, both technically and for completenes contained in this hardcopy data package has e, as verified by the following signatures.	ss, except for	the conditi	ons detailed above. Release of
Prepared	d by:	C. Hopper		Date:	4/15/12
Reviewe	ed by:	Delaino		Date:	06/18/12

**Client Information** 

Client Sample ID: GP301-10'-11'

Project Name: NW Pipe Sample Date: 05/31/12 Sample Time: 09:30

Type: Grab Matrix: Soil Basis: Dry Weight **Lab Information** 

Lab Sample ID: L175401

Date Received: 06/01/12

Dilution Factor: 1

Report Revision No.: 0

Analyte		CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
		CAS#		NL_	Nesuit	Qualifier	Units	Metriod	Ariaiyzeu
GC Semi-Volatiles	·								
TPH-Oil		TPH-Oil	1.32	118	92.2	J	mg/Kg	NWTPH-DX	06/13/12
TPH-Diesel		TPH-Diesel	0.98	29.5	84.5		mg/Kg	NWTPH-DX	06/13/12
	Surrogate		<u>% Re</u>	ecovery	Contr	ol Limits	<u>Quali</u>	<u>fier</u>	
	o-Terphenyl		•	100	50	)-150			
	Octacosane			110	50	)-150			

**Client Information** 

Client Sample ID: GP302-7'-8'

Project Name: NW Pipe Sample Date: 05/31/12 Sample Time: 10:00 Type: Grab

Matrix: Soil
Basis: Dry Weight

o-Terphenyl

Octacosane

**Lab Information** 

Lab Sample ID: L175402

Date Received: 06/01/12

Dilution Factor: 50 Report Revision No.: 0

2

50-150

50-150

					Sample			Analysis	Date
Analyte		_CAS#	DL	RL	Result	Qualifier	Units	Method	Analyzed
GC Semi-Volatiles									
TPH-Oil		TPH-Oil	61.9	5550	2650	J	mg/Kg	NWTPH-DX	06/13/12
TPH-Diesel		TPH-Diesel	46.0	1390	13900		mg/Kg	NWTPH-DX	06/13/12
	<u>Surrogate</u>		<u>% Re</u>	ecovery	<u>Contr</u>	ol Limits	Quali	<u>ifier</u>	

0

0

U=Not detected at specified reporting limit J=Estimated value below reporting limit E=Estimated value above calibration range

**Client Information** 

Client Sample ID: GP303-9.5'-10.5'

Project Name: NW Pipe Sample Date: 05/31/12 Sample Time: 10:30 Type: Grab

Matrix: Soil
Basis: Dry Weight

**Lab Information** 

Lab Sample ID: L175403

Date Received: 06/01/12

Dilution Factor: 1

Report Revision No.: 0

				Sample			Analysis	Date
Analyte	CAS	# DL	RL	Result	Qualifier	Units	Method	Analyzed
GC Semi-Volatiles								
TPH-Oil	TPH-	Oil 1.3	) 116	7.52	J	mg/Kg	NWTPH-DX	06/13/12
TPH-Diesel	TPH-D	iesel 0.9	6 29.0	2.60	J	mg/Kg	NWTPH-DX	06/13/12
	Surrogate	<u>%</u>	Recovery	<u>Cont</u>	rol Limits	Quali	<u>ifier</u>	
c	-Terphenyl		101	5	0-150			
(	Octacosane		109	5	0-150			

**Client Information** 

Client Sample ID: GP304-9.5'-10.5'

Project Name: NW Pipe Sample Date: 05/31/12 Sample Time: 11:00

> Type: Grab Matrix: Soil Basis: Dry Weight

> > o-Terphenyl

Octacosane

**Lab Information** 

Lab Sample ID: L175404

Date Received: 06/01/12

Dilution Factor: 1
Report Revision No.: 0

50-150

50-150

				Sample			<b>Analysis</b>	Date
Analyte	CAS#	DL	RL	Result	Qualifier	Units	Method	Analyzed
GC Semi-Volatiles								
TPH-Oil	TPH-Oil	1.31	118	40.7	J	mg/Kg	NWTPH-DX	06/13/12
TPH-Diesel	TPH-Diesel	0.97	29.4	20.0	J	mg/Kg	NWTPH-DX	06/13/12
<u>s</u>	<u>Surrogate</u>	<u>% Re</u>	covery	Contr	ol Limits	<u>Qual</u>	<u>ifier</u>	

99

109

U=Not detected at specified reporting limit J=Estimated value below reporting limit E=Estimated value above calibration range \*=See case narrative

**Client Information** 

Client Sample ID: GP305-9.5'-10.5'

Project Name: NW Pipe Sample Date: 05/31/12 Sample Time: 11:30 Type: Grab

Matrix: Soil
Basis: Dry Weight

**Lab Information** 

Lab Sample ID: L175405

Date Received: 06/01/12

Dilution Factor: 1
Report Revision No.: 0

			Sample			Analysis	Date
CAS#	DL	RL	Result	Qualifier	Units	Method	Analyzed
							-
TPH-Oil	1.31	117	6.53	J	mg/Kg	NWTPH-DX	06/13/12
TPH-Diesel	0.97	29.3	2.24	J	mg/Kg	NWTPH-DX	06/13/12
	TPH-Oil	TPH-Oil 1.31	TPH-Oil 1.31 117	CAS#         DL         RL         Result           TPH-Oil         1.31         117         6.53	CAS# DL RL Result Qualifier  TPH-Oil 1.31 117 6.53 J	CAS# DL RL Result Qualifier Units  TPH-Oil 1.31 117 6.53 J mg/Kg	CAS# DL RL Result Qualifier Units Method  TPH-Oil 1.31 117 6.53 J mg/Kg NWTPH-DX

<u>Surrogate</u>	% Recovery	<b>Control Limits</b>	Qualifier
o-Terphenyl	99	50-150	
Octacosane	108	50-150	

**CH2M HILL ASL** 

**Client Information** 

Client Sample ID: SB2-0608

Project Name: NW Pipe Sample Date: N/A Sample Time: N/A

> Type: QC Matrix: Soil Basis: Dry Weight

Lab Information

Lab Sample ID: SB2-0608

Date Received: N/A
Dilution Factor: 1
Report Revision No.: 0

Analyte	CAS#	DL	RL	Sample Result	Qualifier	Units	Analysis Method	Date Analyzed
GC Semi-Volatiles			_		_			
TPH-Oil	TPH-Oil	1.12	100	1.12	U	mg/Kg	NWTPH-DX	06/13/12
TPH-Diesel	TPH-Diesel	0.83	25.0	0.84	J	mg/Kg	NWTPH-DX	06/13/12
	Surrogate	<u>% Re</u>	ecovery	<u>Contr</u>	ol Limits	<u>Quali</u>	<u>fier</u>	
o-Te	rphenyl		100	50	0-150			
Octa	cosane		106	50	0-150			

**Client Information** 

Client Sample ID: BS2S0608

Project Name: NW Pipe

Type: QC Matrix: Soil **Lab Information** 

Lab Sample ID: BS2S0608

Dilution Factor: 1
Report Revision No.: 0

Analyte		CAS#	Spike Amount	Sample Result	Units	%Recovery	Analysis Method	Date Analyzed
GC Semi-Volatiles								
TPH-Diesel		TPH-Diesel	103	95.5	mg/Kg	93	NWTPH-DX	06/13/12
	Surrogate		% Red	covery	Control Limits	Qualif	fier	
	o-Terphenyl		10	01	50-150			
	Octacosane		10	07	50-150			

**Client Information** 

Client Sample ID: BS3S0608

Project Name: NW Pipe

Type: QC Matrix: Soil **Lab Information** 

Lab Sample ID: BS3S0608

Dilution Factor: 1
Report Revision No.: 0

Analyte		CAS#	Spike Amount	Sample Result	Units	%Recovery	Analysis Method	Date Analyzed
GC Semi-Volatiles TPH-Oil		TPH-Oil	101	98.8	mg/Kg	98	NWTPH-DX	06/13/12
	Surrogate		% Red	covery	Control Limits	Qualif	ier	
	o-Terphenyl		10	01	50-150			
	Octacosane		10	09	50-150			

# CASE NARRATIVE METALS ANALYSIS

Lab Nar	ne: <u>CF</u>	H2M HILL/LAB/CVO	ASL SDG#:	<u>L1754</u>
Project:	<u>NW F</u>	Pipe	Project #:	358932.TT.06.01
I.		(s): s: SW6010, SW7471 tion: METHOD, SW3050		
II.	- •	/Holding Times: eptance criteria were met.		
III.	<u>Analysi</u>	<u>s:</u>		
	A.	Initial Calibration(s): All acceptance criteria were met.		
	В.	Calibration Verification(s): All acceptance criteria were met.		
	C.	Blanks: All acceptance criteria were met.		
	D.	Laboratory Control Sample(s): All acceptance criteria were met.		
	E.	Matrix Spike/Matrix Spike Duplicate Sam Analyzed in accordance with standard ope		dure.
	F.	Interference Check Sample(s): All acceptance criteria were met.		
	G.	Serial Dilution(s): Analyzed in accordance with standard ope	rating proced	dure.
	Н.	<u>Digestion Exception(s):</u> None.		
	I.	Analytical Exception(s): None.		
IV.	Docume	entation Exception(s):		
	None.			

V. I certify that this data package is in compliance with the terms and conditions agreed to by the client and CH2M HILL, both technically and for completeness, except for the conditions detailed above. Release of the data contained in this hardcopy data package has been authorized by the Laboratory Manager or designee, as verified by the following signatures.

Prepared by: Date: 6-14-17

Reviewed by: Date: 66-14-12

**Client Information** 

Client Sample ID: GP302-7'-8'

Project Name: NW Pipe Sample Date: 05/31/12 Sample Time: 10:00

Type: Grab
Matrix: Soil

Basis: Dry Weight

#### **Lab Information**

Lab Sample ID: L175402

Date Received: 06/01/12

Report Revision No.: 0

		Dilution			Sample			Analysis	Date
Analyte	CAS#	Factor	DL	RL	Result	Qualifier	Units	Method	Analyzed
Metals				_					
Arsenic	7440-38-2	1	0.20	1.20	2.52		mg/Kg	SW6010B	06/07/12
Cadmium	7440-43-9	1	0.0068	0.24	0.15	J	mg/Kg	SW6010B	06/07/12
Chromium	7440-47-3	1	0.033	0.48	7.23		mg/Kg	SW6010B	06/07/12
Copper	7440-50-8	1	0.096	0.48	8.23		mg/Kg	SW6010B	06/07/12
Lead	7439-92-1	1	0.11	0.24	1.76		mg/Kg	SW6010B	06/07/12
Manganese	7439-96-5	1	0.023	0.48	149		mg/Kg	SW6010B	06/07/12
Mercury	7439-97-6	1	0.0022	0.0087	0.017		mg/Kg	SW7471A	06/13/12
Nickel	7440-02-0	1	0.039	0.96	11.7		mg/Kg	SW6010B	06/07/12
Zinc	7440-66-6	1	0.080	0.96	26.8		mg/Kg	SW6010B	06/07/12

U=Not detected at specified reporting limit J=Estimated value below reporting limit E=Estimated value above calibration range

**Client Information** 

Client Sample ID: SB1-0604

Project Name: NW Pipe Sample Date: N/A Sample Time: N/A

Type: QC Matrix: Soil

Basis: Dry Weight

#### **Lab Information**

Lab Sample ID: SB1-0604

Date Received: N/A Report Revision No.: 0

		Dilution			Sample		Analysis	Date	
Analyte	CAS#	Factor	DL	RL	Result	Qualifier	Units	Method	Analyzed
Metals									
Arsenic	7440-38-2	1	0.42	2.50	0.42	U	mg/Kg	SW6010B	06/07/12
Cadmium	7440-43-9	1	0.014	0.50	0.014	U	mg/Kg	SW6010B	06/07/12
Chromium	7440-47-3	1	0.069	1.00	0.069	U	mg/Kg	SW6010B	06/07/12
Copper	7440-50-8	1	0.20	1.00	0.20	U	mg/Kg	SW6010B	06/07/12
Lead	7439-92-1	1	0.23	0.50	0.23	U	mg/Kg	SW6010B	06/07/12
Manganese	7439-96-5	1	0.047	1.00	0.047	U	mg/Kg	SW6010B	06/07/12
Nickel	7440-02-0	1	0.081	2.00	0.081	U	mg/Kg	SW6010B	06/07/12
Zinc	7440-66-6	1	0.17	2.00	0.17	U	mg/Kg	SW6010B	06/07/12

U=Not detected at specified reporting limit J=Estimated value below reporting limit E=Estimated value above calibration range

**Client Information** 

Client Sample ID: SB1-0612

Project Name: NW Pipe Sample Date: N/A Sample Time: N/A

> Type: QC Matrix: Soil Basis: Dry Weight

Lab Information

Lab Sample ID: SB1-0612

Date Received: N/A Report Revision No.: 0

Analyte	CAS#	Dilution Factor	DL_	RL_	Sample Result		Units	Analysis Method	Date Analyzed
Metals									
Mercury	7439-97-6	1	0.0050	0.020	0.0050	U	mg/Kg	SW7471A	06/13/12

CH2M HILL ASL

**Client Information** 

Client Sample ID: BS1S0604

Project Name: NW Pipe

Type: QC Matrix: Soil **Lab Information** 

Lab Sample ID: BS1S0604

Dilution Factor: 1 Report Revision No.: 0

		Spike	Sample		· · · · · · · · · · · · · · · · · · ·	Analysis	Date	
Analyte	CAS#	Amount	Result	Units	%Recovery	Method	Analyzed	
/letals			<u> </u>					
Arsenic	7440-38-2	50.0	47.4	mg/Kg	95	SW6010B	06/07/12	
Cadmium	7440-43-9	50.0	47.5	mg/Kg	95	SW6010B	06/07/12	
Chromium	7440-47-3	50.0	48.8	mg/Kg	98	SW6010B	06/07/12	
Copper	7440-50-8	50.0	47.7	mg/Kg	95	SW6010B	06/07/12	
_ead	7439-92-1	50.0	48.0	mg/Kg	96	SW6010B	06/07/12	
Manganese	7439-96-5	50.0	48.4	mg/Kg	97	SW6010B	06/07/12	
Nickel	7440-02-0	50.0	43.9	mg/Kg	88	SW6010B	06/07/12	
Zinc	7440-66-6	50.0	47.4	mg/Kg	95	SW6010B	06/07/12	

U=Not detected at specified reporting limit J=Estimated value below reporting limit E=Estimated value above calibration range

**Client Information** 

Client Sample ID: BS1S0612

Project Name: NW Pipe

Type: QC Matrix: Soil Lab Information

Lab Sample ID: BS1S0612

Dilution Factor: 1
Report Revision No.: 0

Analyte	CAS#	Spike Amount	Sample Result	Units	%Recovery	Analysis Method	Date Analyzed
Metals							
Mercury	7439-97-6	0.20	0.23	mg/Kg	113	SW7471A	06/13/12

U=Not detected at specified reporting limit J=Estimated value below reporting limit E=Estimated value above calibration range \*=See case narrative

# CASE NARRATIVE GENERAL CHEMISTRY ANALYSIS

Lab Nai	me: <u>C</u>	H2M HILL/LAB/CVO	ASL SDG#:	<u>L1754</u>	
Project:	<u>NW</u>	<u>Pipe</u>	Project #:	358932.TT	<u>C.06.01</u>
I.	Method Analys	<u>d(s):</u> is: LYDKHN			
II.	-	t/Holding Times: eptance criteria were met.			
III.	<u>Analys</u>	<u>is:</u>			
	A.	Initial Calibration(s): All acceptance criteria were met.			
	B.	Calibration Verification(s): All acceptance criteria were met.			
	C.	Blanks: All acceptance criteria were met.			
	D.	<u>Laboratory Control Sample(s):</u> All acceptance criteria were met.			
	E.	Matrix Spike/Matrix Spike Duplicate Sar Analyzed in accordance with standard op		dure.	
	F.	Analytical Exception(s): None.			
IV.	Docum None.	nentation Exception(s):			
V.	CH2M the dat	y that this data package is in compliance wi HILL, both technically and for completened a contained in this hardcopy data package has verified by the following signatures.	ess, except for	the condition	ons detailed above. Release of
Prepare	d by:	Jama McKinley		Date:	6.13.12 6/14/12
Review	ed by:	Kathy makney		Date:	<u>GMIZ</u>

**Client Information** 

**Project Name: NW Pipe** 

Date Received: 06/01/12

Type: See C.O.C. Matrix: Soil

Basis: Dry Weight

**Lab Information** 

Lab Batch ID: L1754

Analysis Method: LYDKHN

Units: mg/Kg

Report Revision No.: 0

		Dilution		Total Organic Carbon				
Client Sample ID	Lab Sample ID	Factor	DL	RL Result		Qualifier	Analyzed	
General Chemistry		-						
GP302-7'-8'	L175402	1	60.5	169	13400		06/13/12	
GP306-10.5'-11.5'	L175406	1	35.4	98.6	269		06/13/12	
GP307-13'-14'	L175407	1	35.5	99.0	277		06/13/12	
SB1-0613	SB1-0613	1	35.9	100	35.9	U	06/13/12	

CH2M HILL ASL

**Client Information** 

Project Name: NW Pipe

**Lab Information** 

Lab Batch ID: L1754

Type: QC

Matrix: Soil

Basis: Dry Weight

Report Revision No.: 0

LCS ID	Analyte	Spike Amount	Sample Result	Units	% Recovery	Analysis Method	Date Analyzed
General Chemistry BS1S0613	Total Organic Carbon	1180	1260	mg/Kg	107	LYDKHN	06/13/12



# Sample Receipt Record

Batch Number: L1754	-	Date received:	<u>6/1/</u>	12	
Checked by:  Checked Samples  Addiological Screening for DoL  Bullion Bullion  Checked by:  Chec	gm				
•		Checked by:	9		
VERIFICATION OF SAMPLE CONDITIONS (verify a	all items), HD = Client Hand delivered	Samples	NA	YES	NO
Radiological Screening for DoD			/		
Were custody seals intact and on the outside of th	e cooler?			/	
Type of packing material: Ice Blue lee Bubble w	rap			1	
Was a Chain of Custody (CoC) Provided?				1	
Was the CoC correctly filled out (If No, document	in the SRER)			/	
Did the CoC list a correct bottle count and the pres	servative types (Y=OK, N	=Corrected on CoC)		/	
Were the sample containers in good condition (bro	oken or leaking)?			/	_
Containers supplied by ASL?				/	
Any sample with < 1/2 holding time remaining? If	so contact LPM				/
Samples have multi-phase? If yes, document on S	SRER				/
Was there ice in the cooler? Enter temp. If >6°C of	contact client/SRER	H.D. 11.5 °C			
All VOCs free of air bubbles? No, document on S	RER		5		
pH of all samples checked and met requirements?	No, then document in SI	RER	/		
Enough sample volume provided for analysis? No	, document in SRER			V	
Did sample labels agree with COC? No, document	t in SRER			/	
Dissolved/Soluble metals filtered in the field?			/		
Dissolved/Soluble metals have sediment in bottom	n of container? Document	in SRER	/		
Sample ID	Reagent	Reagent Lot Number	Volume	Added	Initials
					_



THE LEADER IN ENVIRONMENTAL TESTING

# **ANALYTICAL REPORT**

TestAmerica Laboratories, Inc.

TestAmerica Seattle 5755 8th Street East Tacoma, WA 98424 Tel: (253)922-2310

TestAmerica Job ID: 580-33207-1 Client Project/Site: EPH/VPH

#### For:

CH2M Hill Constructors, Inc. 2300 NW Walnut Boulevard Corvallis, Oregon 97330

Attn: Kathy McKinley

Knistine D. allen

Authorized for release by: 6/20/2012 1:00:09 PM

Kristine Allen Project Manager I

kristine.allen@testamericainc.com

·····LINKS ·······

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**Have a Question?** 



Visit us at: www.testamericainc.com

This report has been electronically signed and authorized by the signatory. Electronic signature is intended to be the legally binding equivalent of a traditionally handwritten signature.

Results relate only to the items tested and the sample(s) as received by the laboratory.

Client: CH2M Hill Constructors, Inc. Project/Site: EPH/VPH

TestAmerica Job ID: 580-33207-1

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#### **Case Narrative**

Client: CH2M Hill Constructors, Inc.

Project/Site: EPH/VPH

TestAmerica Job ID: 580-33207-1

#### Job ID: 580-33207-1

#### **Laboratory: TestAmerica Seattle**

#### Narrative

#### Receipt

The samples were received on 6/2/2012 10:10 AM; the samples arrived in good condition, properly preserved and, where required, on ice. The temperature of the cooler at receipt was 4.4° C.

**GC/MS VOA** - Method NWTPH/VPHThe method blank for batch 112889 contained several ranges above the method detection limit. These target analyte concentrations were less than 1/2 the reporting limit (RL); therefore, re-extraction and/or re-analysis of samples was not performed.

No other analytical or quality issues were noted.

#### GC Semi VOA - Method NWTPH/EPH

Surrogate recovery of o-Terphenyl for the following sample was outside control limits: GP302-7'-8' (580-33207-2). Evidence of matrix interference is present, as this sample required a dilution; therefore, re-extraction and/or re-analysis was not performed.

No other analytical or quality issues were noted.

#### **General Chemistry**

No analytical or quality issues were noted.

#### **Organic Prep**

No analytical or quality issues were noted.

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### **Definitions/Glossary**

Client: CH2M Hill Constructors, Inc.

Project/Site: EPH/VPH

TestAmerica Job ID: 580-33207-1

#### **Qualifiers**

#### **GC VOA**

Qualifier	Qualifier Description
U	Undetected at the Limit of Detection.
J	Estimated: The analyte was positively identified; the quantitation is an estimation
D	The reported value is from a dilution.

#### GC Semi VOA

Qualifier Description
Estimated: The analyte was positively identified; the quantitation is an estimation
Manual integrated compound.
Undetected at the Limit of Detection.
Estimated: The quantitation is an estimation due to discrepancies in meeting certain analyte-specific quality control criteria.
One or more quality control criteria failed.
The reported value is from a dilution.

#### Glossary

Abbreviation	These commonly used abbreviations may or may not be present in this report.
<del>\$</del>	Listed under the "D" column to designate that the result is reported on a dry weight basis
%R	Percent Recovery
CNF	Contains no Free Liquid
DL, RA, RE, IN	Indicates a Dilution, Reanalysis, Re-extraction, or additional Initial metals/anion analysis of the sample
EDL	Estimated Detection Limit
EPA	United States Environmental Protection Agency
MDL	Method Detection Limit
ML	Minimum Level (Dioxin)
ND	Not detected at the reporting limit (or MDL or EDL if shown)
PQL	Practical Quantitation Limit
QC	Quality Control
RL	Reporting Limit
RPD	Relative Percent Difference, a measure of the relative difference between two points
TEF	Toxicity Equivalent Factor (Dioxin)
TEQ	Toxicity Equivalent Quotient (Dioxin)

Client: CH2M Hill Constructors, Inc.

Project/Site: EPH/VPH

Client Sample ID: GP301-10'-11'

Date Received: 06/02/12 10:10

Lab Sample ID: 580-33207-1 Date Collected: 05/31/12 09:30

Matrix: Solid Percent Solids: 81.1

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
C5-C6 Aliphatics	0.42	J	2.5	0.12	mg/Kg	*	06/04/12 08:15	06/08/12 01:08	1
C6-C8 Aliphatics	0.31	J	2.5	0.12	mg/Kg	₽	06/04/12 08:15	06/08/12 01:08	1
C8-C10 Aliphatics	0.37	U	2.5	0.12	mg/Kg	₽	06/04/12 08:15	06/08/12 01:08	1
C10-C12 Aliphatics	0.37	U	2.5	0.12	mg/Kg	₽	06/04/12 08:15	06/08/12 01:08	1
C8-C10 Aromatics	0.15	J	2.5	0.12	mg/Kg	₽	06/04/12 08:15	06/08/12 01:08	1
C10-C12 Aromatics	0.12	J	2.5	0.12	mg/Kg	₽	06/04/12 08:15	06/08/12 01:08	1
C12-C13 Aromatics	0.26	J	2.5	0.12	mg/Kg	*	06/04/12 08:15	06/08/12 01:08	1
Total VPH	1.3	J	17	0.12	mg/Kg	₩	06/04/12 08:15	06/08/12 01:08	1
Surrogate	%Recovery	Qualifier	Limits				Prepared	Analyzed	Dil Fac
4-Bromofluorobenzene	105		60 - 140				06/04/12 08:15	06/08/12 01:08	1
BFB - PID	104		60 - 140				06/04/12 08:15	06/08/12 01:08	1

Surrogate	%Recovery	Qualifier	Limits				Prepared	Analyzea	DII Fac
4-Bromofluorobenzene	105		60 - 140				06/04/12 08:15	06/08/12 01:08	1
BFB - PID	104		60 - 140				06/04/12 08:15	06/08/12 01:08	1
_ Method: NWTPH/EPH - Northy	west - Extractable	Petroleum	Hydrocarbons	(GC)					
Analyte		Qualifier	LOQ		Unit	D	Prepared	Analyzed	Dil Fac
C10-C12 Aliphatics	0.24	U	6.1	0.12	mg/Kg	<del></del>	06/04/12 13:51	06/15/12 14:17	1
C12-C16 Aliphatics	1.2	J	6.1	1.2	mg/Kg	₽	06/04/12 13:51	06/15/12 14:17	1
C16-C21 Aliphatics	15		6.1	1.2	mg/Kg	₩	06/04/12 13:51	06/15/12 14:17	1
C21-C34 Aliphatics	23		6.1	1.2	mg/Kg	₽	06/04/12 13:51	06/15/12 14:17	1
C10-C12 Aromatics	0.12	J	6.1	0.088	mg/Kg	₩	06/04/12 13:51	06/15/12 14:17	1
C12-C16 Aromatics	1.3	J	6.1	1.2	mg/Kg	₩	06/04/12 13:51	06/15/12 14:17	1
C16-C21 Aromatics	30		6.1	1.2	mg/Kg	₽	06/04/12 13:51	06/15/12 14:17	1
C21-C34 Aromatics	84		6.1	1.2	mg/Kg	₽	06/04/12 13:51	06/15/12 14:17	1
Surrogate	%Recovery	Qualifier	Limits				Prepared	Analyzed	Dil Fac
o-Terphenyl	110	М	60 - 140				06/04/12 13:51	06/15/12 14:17	1
1-Chlorooctadecane	103		60 - 140				06/04/12 13:51	06/15/12 14:17	1
General Chemistry									
Analyte	Result	Qualifier	LOQ	LOQ	Unit	D	Prepared	Analyzed	Dil Fac
Percent Solids	81		0.10	0.10	%			06/06/12 14:39	1
Percent Moisture	19		0.10	0.10	%			06/06/12 14:39	1

Client: CH2M Hill Constructors, Inc.

Project/Site: EPH/VPH

Client Sample ID: GP302-7'-8'

Date Collected: 05/31/12 10:00 Date Received: 06/02/12 10:10 8' Lab Sample ID: 580-33207-2

Matrix: Solid Percent Solids: 83.3

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
C5-C6 Aliphatics	3.6	U	24	1.2	mg/Kg	*	06/04/12 08:15	06/08/12 02:53	10
C6-C8 Aliphatics	3.9	J D	24	1.2	mg/Kg	₽	06/04/12 08:15	06/08/12 02:53	10
C8-C10 Aliphatics	1.2	J D	24	1.2	mg/Kg	₽	06/04/12 08:15	06/08/12 02:53	10
C10-C12 Aliphatics	2.3	JD	24	1.2	mg/Kg	₽	06/04/12 08:15	06/08/12 02:53	10
C8-C10 Aromatics	3.7	J D	24	1.2	mg/Kg	₽	06/04/12 08:15	06/08/12 02:53	10
C10-C12 Aromatics	5.8	J D	24	1.2	mg/Kg	₽	06/04/12 08:15	06/08/12 02:53	10
C12-C13 Aromatics	50	D	24	1.2	mg/Kg	₽	06/04/12 08:15	06/08/12 02:53	10
Total VPH	68	J D	170	1.2	mg/Kg	\$	06/04/12 08:15	06/08/12 02:53	10
Surrogate	%Recovery	Qualifier	Limits				Prepared	Analyzed	Dil Fac
4-Bromofluorobenzene	104		60 - 140				06/04/12 08:15	06/08/12 02:53	10
BFB - PID	105		60 - 140				06/04/12 08:15	06/08/12 02:53	10
- Method: NWTPH/EPH - Nort	thwest - Extractable	Petroleum	Hydrocarbons	(GC)					
Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
C10-C12 Aliphatics	1.0	J	12	0.23	mg/Kg	<del>-</del>	06/04/12 13:51	06/15/12 14:48	1
	74		12	2.4	mg/Kg	₽	06/04/12 13:51	06/15/12 14:48	1
C12-C16 Aliphatics	74								
C12-C16 Aliphatics C16-C21 Aliphatics	290	J	12	2.4	mg/Kg	☼	06/04/12 13:51	06/15/12 14:48	1

C10-C12 Aromatics	10	J	12	0.17 mg/Kg	≎	06/04/12 13:51	06/15/12 14:48	1
C12-C16 Aromatics	510	J	12	2.4 mg/Kg	₽	06/04/12 13:51	06/15/12 14:48	1
Surrogate	%Recovery	Qualifier	Limits			Prepared	Analyzed	Dil Fac
Julioguic	7011CCCVC1 y	Quanner	Lillits			rrepared	Analyzea	<i>Dir i</i> ao
o-Terphenyl		Q	60 <sub>-</sub> 140			06/04/12 13:51	06/15/12 14:48	1

Method: NWTPH/EPH - Northwest - Extractable Petroleum Hydrocarbons (GC) - DL										
	Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
	C16-C21 Aromatics	8900	D	1200	240	mg/Kg	<del>\$</del>	06/04/12 13:51	06/15/12 15:15	100
	C21-C34 Aromatics	3400	D	1200	240	mg/Kg	₩	06/04/12 13:51	06/15/12 15:15	100

General Chemistry							
Analyte	Result Qualifier	LOQ	LOQ Unit	D	Prepared	Analyzed	Dil Fac
Percent Solids	83	0.10	0.10 %			06/06/12 14:39	1
Percent Moisture	17	0.10	0.10 %			06/06/12 14:39	1

TestAmerica Job ID: 580-33207-1

Client: CH2M Hill Constructors, Inc.

Project/Site: EPH/VPH

#### Method: NWTPH/VPH - Northwest - Volatile Petroleum Hydrocarbons (GC)

Lab Sample ID: MB 580-112884/1-A Client Sample ID: Method Blank **Matrix: Solid** Prep Type: Total/NA Prep Batch: 112884 Analysis Batch: 112889

	MB	MR							
Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
C5-C6 Aliphatics	0.363	J	2.0	0.10	mg/Kg		06/07/12 15:31	06/07/12 20:17	1
C6-C8 Aliphatics	0.256	J	2.0	0.10	mg/Kg		06/07/12 15:31	06/07/12 20:17	1
C8-C10 Aliphatics	0.30	U	2.0	0.10	mg/Kg		06/07/12 15:31	06/07/12 20:17	1
C10-C12 Aliphatics	0.147	J	2.0	0.10	mg/Kg		06/07/12 15:31	06/07/12 20:17	1
C8-C10 Aromatics	0.160	J	2.0	0.10	mg/Kg		06/07/12 15:31	06/07/12 20:17	1
C10-C12 Aromatics	0.192	J	2.0	0.10	mg/Kg		06/07/12 15:31	06/07/12 20:17	1
C12-C13 Aromatics	0.454	J	2.0	0.10	mg/Kg		06/07/12 15:31	06/07/12 20:17	1
Total VPH	1.61	J	14	0.10	mg/Kg		06/07/12 15:31	06/07/12 20:17	1

MB MB

Surrogate	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
4-Bromofluorobenzene	105		60 - 140	06/07/12 15:31	06/07/12 20:17	1
BFB - PID	107		60 - 140	06/07/12 15:31	06/07/12 20:17	1

Lab Sample ID: LCS 580-112884/2-A

**Matrix: Solid** 

Analysis Batch: 112889

**Client Sample ID: Lab Control Sample** Prep Type: Total/NA Prep Batch: 112884

	Spike	LCS	LCS				%Rec.	
Analyte	Added	Result	Qualifier	Unit	D	%Rec	Limits	
C5-C6 Aliphatics	8.00	7.43		mg/Kg		93	70 - 130	
C6-C8 Aliphatics	4.00	4.06		mg/Kg		101	70 - 130	
C8-C10 Aliphatics	8.00	8.43		mg/Kg		105	70 - 130	
C10-C12 Aliphatics	4.00	4.63		mg/Kg		116	70 - 130	
C8-C10 Aromatics	16.0	15.9		mg/Kg		99	70 - 130	
C10-C12 Aromatics	4.00	3.89		mg/Kg		97	70 - 130	
C12-C13 Aromatics	8.00	7.44		mg/Kg		93	70 - 130	

LCS LCS

Surrogate	%Recovery Qu	ıalifier	Limits
4-Bromofluorobenzene	106		60 - 140
BFB - PID	104		60 - 140

Lab Sample ID: LCSD 580-112884/3-A

**Matrix: Solid** 

Analysis Batch: 112889

Client Sample ID: Lab Control Sample Dup

Prep Type: Total/NA Prep Batch: 112884

LCSD LCSD Spike %Rec. RPD Analyte Added Result Qualifier Unit %Rec Limits Limit C5-C6 Aliphatics 8.00 7.14 mg/Kg 89 70 - 130 4 25 4.00 70 - 130 C6-C8 Aliphatics 3.81 mg/Kg 95 6 25 C8-C10 Aliphatics 8.00 7.98 70 - 130 25 mg/Kg 100 5 C10-C12 Aliphatics 4.00 4.40 mg/Kg 110 70 - 130 25 C8-C10 Aromatics 16.0 16.1 mg/Kg 101 70 - 130 25 C10-C12 Aromatics 97 25 4.00 3.87 mg/Kg 70 - 130 C12-C13 Aromatics 8.00 7.26 70 - 130 mg/Kg

ate	%Recovery	Qualifier
	LCSD	LCSD

Surrogate	%Recovery	Qualifier	Limits
4-Bromofluorobenzene	102		60 - 140
BFB - PID	103		60 - 140

Client: CH2M Hill Constructors, Inc.

Project/Site: EPH/VPH

#### Method: NWTPH/EPH - Northwest - Extractable Petroleum Hydrocarbons (GC)

MR MR

Lab Sample ID: MB 580-112572/1-B

Matrix: Solid

Analysis Batch: 113372

**Client Sample ID: Method Blank** Prep Type: Total/NA

**Prep Batch: 112572** 

	1410	IND							
Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
C10-C12 Aliphatics	0.20	U	5.0	0.095	mg/Kg		06/04/12 13:51	06/14/12 20:15	1
C12-C16 Aliphatics	2.0	U	5.0	1.0	mg/Kg		06/04/12 13:51	06/14/12 20:15	1
C16-C21 Aliphatics	2.0	U	5.0	1.0	mg/Kg		06/04/12 13:51	06/14/12 20:15	1
C21-C34 Aliphatics	2.0	U	5.0	1.0	mg/Kg		06/04/12 13:51	06/14/12 20:15	1
C10-C12 Aromatics	0.0934	J	5.0	0.072	mg/Kg		06/04/12 13:51	06/14/12 20:15	1
C12-C16 Aromatics	2.0	U	5.0	1.0	mg/Kg		06/04/12 13:51	06/14/12 20:15	1
C16-C21 Aromatics	2.0	U	5.0	1.0	mg/Kg		06/04/12 13:51	06/14/12 20:15	1
C21-C34 Aromatics	2.19	J M	5.0	1.0	mg/Kg		06/04/12 13:51	06/14/12 20:15	1

MB MB

Surrogate	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
o-Terphenyl	79		60 - 140	06/04/12 13:51	06/14/12 20:15	1
1-Chlorooctadecane	83		60 - 140	06/04/12 13:51	06/14/12 20:15	1

Lab Sample ID: LCS 580-112572/2-B

Matrix: Solid

Analysis Batch: 113372

**Client Sample ID: Lab Control Sample** 

Prep Type: Total/NA

**Prep Batch: 112572** 

	Spike	LCS	LCS				%Rec.	
Analyte	Added	Result	Qualifier	Unit	D	%Rec	Limits	
C10-C12 Aliphatics	6.67	5.61		mg/Kg		84	70 - 130	
C12-C16 Aliphatics	13.3	13.2		mg/Kg		99	70 - 130	
C16-C21 Aliphatics	20.0	22.9		mg/Kg		114	70 - 130	
C21-C34 Aliphatics	40.0	45.2		mg/Kg		113	70 - 130	
C10-C12 Aromatics	6.67	5.19		mg/Kg		78	70 - 130	
C12-C16 Aromatics	20.0	17.5		mg/Kg		88	70 - 130	
C16-C21 Aromatics	40.0	33.3		mg/Kg		83	70 - 130	
C21-C34 Aromatics	53.3	48.2		mg/Kg		90	70 - 130	

LCS LCS

Surrogate	%Recovery	Qualifier	Limits
o-Terphenyl	99		60 - 140
1-Chlorooctadecane	103		60 - 140

Lab Sample ID: LCSD 580-112572/3-B

Matrix: Solid

Analysis Batch: 113372

**Client Sample ID: Lab Control Sample Dup** 

Prep Type: Total/NA

**Prep Batch: 112572** 

	Spike	LCSD	LCSD			%Rec.		RPD	
Analyte	Added	Result	Qualifier Unit	D	%Rec	Limits	RPD	Limit	
C10-C12 Aromatics	6.67	6.02	mg/l		90	70 - 130	15	25	
C12-C16 Aromatics	20.0	20.6	mg/l	<b>(</b> g	103	70 - 130	16	25	
C16-C21 Aromatics	40.0	37.8	mg/l	<b>(</b> g	94	70 - 130	12	25	
C21-C34 Aromatics	53.3	58.0	mg/l	<b>(</b> g	109	70 - 130	19	25	

LCSD LCSD

Surrogate	%Recovery Qualifier	Limits
o-Terphenyl	108	60 - 140

# **QC Sample Results**

Client: CH2M Hill Constructors, Inc.

Lab Sample ID: LCSD 580-112572/3-B

Project/Site: EPH/VPH

Matrix: Solid

TestAmerica Job ID: 580-33207-1

Method: NWTPH/EPH - Northwest - Extractable Petroleum Hydrocarbons (GC) (Continued)

Client Sample ID: Lab Control Sample Dup

Chefit Sample ID. Lab Control Sample Dup
Prep Type: Total/NA
Prep Batch: 112572

Analysis Batch: 113372							Prep	Batch: 1	12572
	Spike	LCSD	LCSD				%Rec.		RPD
Analyte	Added	Result	Qualifier	Unit	D	%Rec	Limits	RPD	Limit
C10-C12 Aliphatics	6.67	4.93	J	mg/Kg		74	70 - 130	13	25
C12-C16 Aliphatics	13.3	11.8		mg/Kg		89	70 - 130	11	25
C16-C21 Aliphatics	20.0	19.7		mg/Kg		98	70 - 130	15	25
C21-C34 Aliphatics	40.0	39.1		mg/Kg		98	70 - 130	15	25

	LCSD	LCSD	
Surrogate	%Recovery	Qualifier	Limits
1-Chlorooctadecane	88		60 - 140

Client: CH2M Hill Constructors, Inc. Project/Site: EPH/VPH

Client Sample ID: GP301-10'-11'

Date Collected: 05/31/12 09:30 Date Received: 06/02/12 10:10

Lab Sample ID: 580-33207-1

**Matrix: Solid** Percent Solids: 81.1

	Batch	Batch		Dilution	Batch	Prepared		
Prep Type	Type	Method	Run	Factor	Number	or Analyzed	Analyst	Lab
Total/NA	Prep	5035			112884	06/04/12 08:15	MAT	TAL SEA
Total/NA	Analysis	NWTPH/VPH		1	112889	06/08/12 01:08	MAT	TAL SEA
Total/NA	Prep	3550B			112572	06/04/12 13:51	KKW	TAL SEA
Total/NA	Analysis	NWTPH/EPH		1	113372	06/15/12 14:17	EK	TAL SEA
Total/NA	Analysis	D 2216		1	112770	06/06/12 14:39	EZ	TAL SEA

Lab Sample ID: 580-33207-2

Client Sample ID: GP302-7'-8' Date Collected: 05/31/12 10:00 **Matrix: Solid** Date Received: 06/02/12 10:10 Percent Solids: 83.3

	Batch	Batch		Dilution	Batch	Prepared		
Prep Type	Type	Method	Run	Factor	Number	or Analyzed	Analyst	Lab
Total/NA	Prep	5035			112884	06/04/12 08:15	MAT	TAL SEA
Total/NA	Analysis	NWTPH/VPH		10	112889	06/08/12 02:53	MAT	TAL SEA
Total/NA	Prep	3550B			112572	06/04/12 13:51	KKW	TAL SEA
Total/NA	Analysis	NWTPH/EPH		1	113372	06/15/12 14:48	EK	TAL SEA
Total/NA	Prep	3550B	DL		112572	06/04/12 13:51	KKW	TAL SEA
Total/NA	Analysis	NWTPH/EPH	DL	100	113372	06/15/12 15:15	EK	TAL SEA
Total/NA	Analysis	D 2216		1	112770	06/06/12 14:39	EZ	TAL SEA

#### **Laboratory References:**

TAL SEA = TestAmerica Seattle, 5755 8th Street East, Tacoma, WA 98424, TEL (253)922-2310

## **Certification Summary**

Client: CH2M Hill Constructors, Inc.

Project/Site: EPH/VPH

TestAmerica Job ID: 580-33207-1

Laboratory	Authority	Program	EPA Region	Certification ID
TestAmerica Seattle	Alaska (UST)	State Program	10	UST-022
TestAmerica Seattle	California	NELAC	9	1115CA
TestAmerica Seattle	Florida	NELAC	4	E871074
TestAmerica Seattle	L-A-B	DoD ELAP		L2236
TestAmerica Seattle	L-A-B	ISO/IEC 17025		L2236
TestAmerica Seattle	Louisiana	NELAC	6	05016
TestAmerica Seattle	Montana (UST)	State Program	8	N/A
TestAmerica Seattle	Oregon	NELAC	10	WA100007
TestAmerica Seattle	USDA	Federal		P330-11-00222
TestAmerica Seattle	Washington	State Program	10	C553

Accreditation may not be offered or required for all methods and analytes reported in this package. Please contact your project manager for the laboratory's current list of certified methods and analytes.

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## **Sample Summary**

Client: CH2M Hill Constructors, Inc.

Project/Site: EPH/VPH

TestAmerica Job ID: 580-33207-1

restAmenta	JUD	ID.	SOO.	-33207	- 1

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
580-33207-1	GP301-10'-11'	Solid	05/31/12 09:30	06/02/12 10:10
580-33207-2	GP302-7'-8'	Solid	05/31/12 10:00	06/02/12 10:10

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Page 13 of 14





Applied Sciences Laboratory (ASL)













33207



1100 NE Circle Blvd. Suite 300 Corvallis, OR 97330 Tel 541.768.3120 asl@ch2m.com

Contract Laboratory Information:

TestAmerica-Seattle Attn: Sample Custody 5755 8th Street East Tacoma, WA 98424

Sample Batch Information:

Client: CONFIDENTIAL

Batch Code: L1754

Date Received: 6/1/2012

Contact: Kathy McKinley

541-752-4271

Billing Information:

Reference Project Number: 163160.AS.OS

Hazardous: No

Report Information:

Reporting Address: CH2M HILL Applied Sciences Laboratory, 1100 NE Circle Blvd, Suite 300, Corvallis, OR 97330

Attention: Kathy McKinley Report Due: 6/14/2012 QA Level: 2

Special Instructions:

Sample ID	Lab ID	Sample Date/Time	Method	Requested Test	Date Due	Matrix
GP301-10'-11'	L175401	5/31/2012 09:30	NWTPH-EPH	TPH-EPH (soil)	6/14/2012	Soil
GP302-7'-8'	L175402	5/31/2012 10:00	NWTPH-EPH	TPH-EPH (soil)	6/14/2012	Soil
GP301-10'-11'	L175401	5/31/2012 09:30	NWTPH-VPH	TPH-VPH (soil)	6/14/2012	Soil
GP302-7'-8'	L175402	5/31/2012 10:00	NWTPH-VPH	TPH-VPH (soil)	6/14/2012	1

Cooler/TB Dig/IR cor/1/ unc 45
Cooler Dscom (2013) @ Lab,
Wel/Packs Packing bubble

The state of the s

Relinquished By Janel McGeary	Date/Time 6/1/12 1400	Received By Athy Cample	Date/Time 10:10
Relinquished By	Date/Time	Received By	Date/fime

Job Number: 580-33207-1

Client: CH2M Hill Constructors, Inc.

List Source: TestAmerica Seattle

Login Number: 33207 List Number: 1 Creator: Riley, Nicole

oreator. Miey, Micole		
Question	Answer	Comment
Radioactivity either was not measured or, if measured, is at or below background	True	
The cooler's custody seal, if present, is intact.	True	
The cooler or samples do not appear to have been compromised or tampered with.	True	
Samples were received on ice.	True	
Cooler Temperature is acceptable.	True	
Cooler Temperature is recorded.	True	
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
s the Field Sampler's name present on COC?	False	Not requested on COC.
There are no discrepancies between the sample IDs on the containers and the COC.	True	
Samples are received within Holding Time.	False	See NCM.
Sample containers have legible labels.	True	
Containers are not broken or leaking.	True	
Sample collection date/times are provided.	True	
Appropriate sample containers are used.	True	
Sample bottles are completely filled.	True	
Sample Preservation Verified.	N/A	
There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs	True	
/OA sample vials do not have headspace or bubble is <6mm (1/4") in diameter.	N/A	
Multiphasic samples are not present.	True	
Samples do not require splitting or compositing.	True	

N/A

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Residual Chlorine Checked.

No analysis requiring residual chlorine check

assigned.

# **Attachment 2**



# **Boring Number: GP-301**

Sheet: 1 of 1

Client: Northwest Pipe Project: Stained Soil

Location: North Portland

Project Number: 358932.TT.06

**Driller:** Cascade Drilling **Drilling Method:** Direct Push

Sampling Method: Continuous Core

**Logged by:** Bruce Pratt **Start/Finish Date:** 5/31/12

	Sa	mple	Inform	nation				
Depth (ft)	Sample	Sample Type	Recovery (ft.)	PID (ppm)	Soil Log	Soil Description	Depth (ft)	Comments
0-					<b>15. 17.</b> 18.	Ground Surface	0	
-	1	СС	2.5			Asphalt  GP  Poorly graded SAND and GRAVEL, brown, dry, loose, fine -med grain sand. Gravel up to 1-inch	0	
5-						SP	5	
-	2	СС	3.5	3.5 ppm		Poorly graded SAND, brown, dry, loose fine - medium grain sand	10	-1/8" wide black line observed in soil core, sheen observed - Soil Sample GP-301 10' -
10-	3	СС	5			SP Poorly graded SAND, dark gray, saturated, loose fine to medium grain sand	10	11' bgs - Wood fiber observed in soil core - 10.5'bgs mdedium sheen observed in soil core  - 14' bgs heavy sheen observed in soil core
15				-	292311111	End of Log	15	
20-						Direct push boring abandoned by filling with hydrated bentonite chips.		



# **Boring Number: GP-302**

Sheet: 1 of 1

Client: Northwest Pipe Project: Stained Soil

Location: North Portland

Project Number: 358932.TT.06

**Driller:** Cascade Drilling **Drilling Method:** Direct Push

Sampling Method: Continuous Core

**Logged by:** Bruce Pratt **Start/Finish Date:** 5/31/12

	Sa	mple	Inform	ation				
Depth (ft)	Sample	Sample Type	Recovery (ft.)	PID (ppm)	Soil Log	Soil Description	Depth (ft)	Comments
0-					S # 03	Ground Surface	0	
-	1	СС	2.5			GP Poorly graded SAND and GRAVEL, brown, dry, loose, fine -med grain sand. Gravel up to 1-inch		
5-						SP Poorly graded SAND, brown, dry, loose	5	
10 1	2	СС	3.5	3.5 ppm		fine - medium grain sand  SP  Poorly graded SAND, Dark Gray, saturated, loose fine to medium grain sand	6	-Geofabric observed in soil  Setter of the served in soil  Soil sample GP302 7' -8' bgs  - Medium sheen observed
15-	3	СС	5				15	- 12' - 14.5' bgs heavy sheen observed  - Background PID reading 1.5
						End of Log	15	- 1.7 ppm
20-						Well MW-7 installed in this boring.		



# **Boring Number: GP-303**

Sheet: 1 of 1

Client: Northwest Pipe Project: Stained Soil

Location: North Portland

Project Number: 358932.TT.06

**Driller:** Cascade Drilling **Drilling Method:** Direct Push

Sampling Method: Continuous Core

	Sa	Sample Information						
Depth (ft)	Sample	Sample Type	Recovery (ft.)	PID (ppm)	Soil Log	Soil Description	Depth (ft)	Comments
0-	1	СС	3.5			Ground Surface  Asphalt  GP  Poorly graded SAND and GRAVEL, brown, dry, loose, fine -med grain sand. Gravel up to 1-inch	0	
5	2	СС	4	1.9 ppm		Poorly graded SAND, brown, dry, loose fine - medium grain sand		-Soil sample GP-303 9.5' - 10.5' bgs
	3	СС	4.5			SP Poorly graded SAND, dark gray, saturated,	15	- No Sheen observed  -No Sheen observed  - Background PID reading 1.4
						End of Log  Direct push boring abandoned by filling with hydrated bentonite chips.		ppm



# **Boring Number: GP-304**

Sheet: 1 of 1

Client: Northwest Pipe Project: Stained Soil

Location: North Portland
Project Number: 358932.TT.06

**Driller:** Cascade Drilling **Drilling Method:** Direct Push

**Sampling Method:** Continuous Core

	Sample Information							
Depth (ft)	Sample	Sample Type	Recovery (ft.)	PID (ppm)	Soil Log	Soil Description		Comments
0-					S. P. O.	Ground Surface	0	
-	1	cc	4			Asphalt  GP Poorly graded SAND and GRAVEL, brown, dry, loose, fine -med grain sand. Gravel up to 1-inch  SP Poorly graded SAND, brown, dry to moist, loose fine - medium grain sand	3	
5-				_				
-	2	СС	4.5			SP	10	- Soil sample GP-304 9.5' - - 10.5'
10-	3	СС	5	4.1 ppm		Poorly graded SAND, dark gray, saturated, loose fine to medium grain sand		-No Sheen observed  - Wood fiber observed throughout soil core, appears burnt or decomposing
15-						End of Log	15	- Background PID 5.9 ppm
-						Direct push boring abandoned by filling with hydrated bentonite chips.		
20-								



# **Boring Number: GP-305**

Sheet: 1 of 1

Client: Northwest Pipe Project: Stained Soil

Location: North Portland

Project Number: 358932.TT.06

**Driller:** Cascade Drilling **Drilling Method:** Direct Push

Sampling Method: Continuous Core

	Sa	mple	Inform	ation				
Depth (ft)	Sample	Sample Type	Recovery (ft.)	PID (ppm)	Soil Log	Soil Description		Comments
0					R. D. O.W.	Ground Surface	0	
-	1	СС	3			Asphalt  GP  Poorly graded SAND and GRAVEL, brown, dry, loose, fine -med grain sand. Gravel up to 1-inch  SP  Poorly graded SAND, brown, dry to moist, loose	3	
5-						fine - medium grain sand		
-	2	СС	3.5					
								- Soil sample GP-305 9.5' - 10.5'
10-				5.8 ppm		SP Poorly graded SAND, dark gray, saturated, loose fine to medium grain sand	10	-No Sheen observed
-	3	СС	5					
15-					31.457	End of Log	15	- Background PID 6.8 ppm
-						Direct push boring abandoned by filling with hydrated bentonite chips.		
20-								



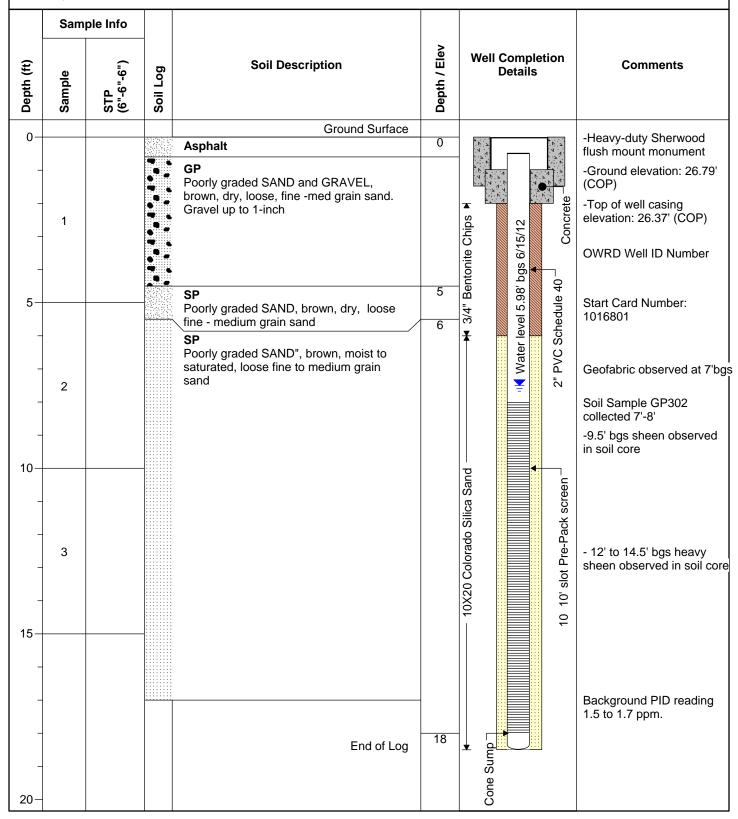
### Well Number: MW-7

Sheet: 1 of 1

Client: Northwest Pipe
Project: Stained Soil

Location: North Portland
Project Number: 358932.TT.06

Driller: Cascade Drilling
Drilling Method: Direct Push
Sampling Method: Continous Core





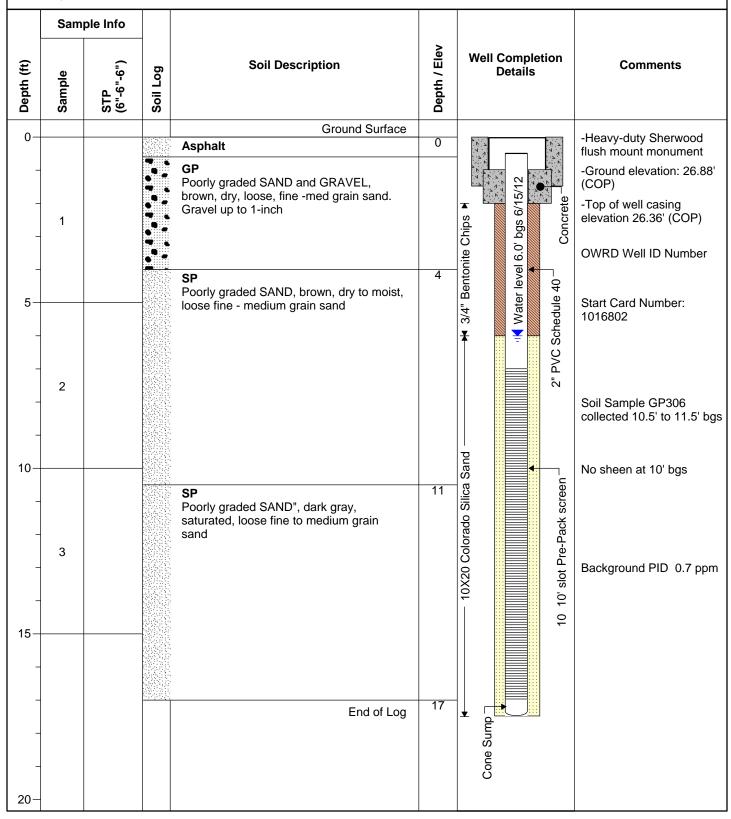
## Well Number: MW-8

Sheet: 1 of 1

Client: Northwest Pipe Project: Stained Soil Location: North Portland

Project Number: 358932.TT.06

**Driller:** Cascade Drilling **Drilling Method:** Direct Push **Sampling Method:** Continous Core





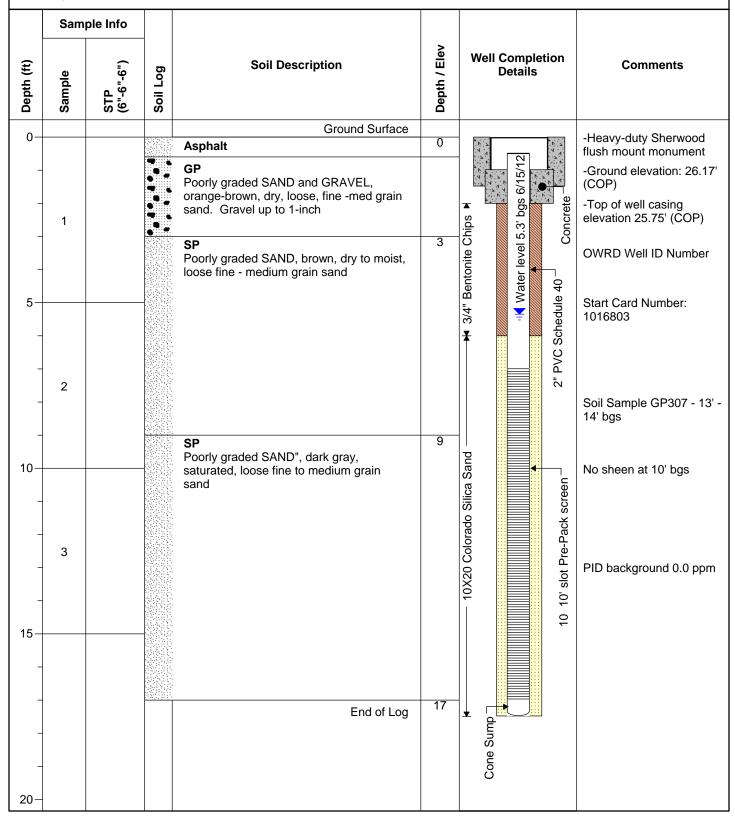
## Well Number: MW-9

Sheet: 1 of 1

Client: Northwest Pipe
Project: Stained Soil

Location: North Portland
Project Number: 358932.TT.06

**Driller:** Cascade Drilling **Drilling Method:** Direct Push **Sampling Method:** Continous Core



## **Attachment 3**

**TPH Fraction Composition (Weight Fraction)** 

		Site-Specific Data		Gen	eric Weight Fraction	Data
Fuel Fractions	Raw Data mg/kg (ppm)	Adjusted Data mg/kg (ppm)	Weight Fraction	Gasoline	Diesel	Mineral Oil
Aliphatic C5-C6	0	0	3.08E-05	2.06E-01	0.00E+00	0.00E+00
Aliphatic >C6-C8	4	4	2.86E-04	2.20E-01	0.00E+00	0.00E+00
Aliphatic >C8-C10	1	1	8.81E-05	9.00E-02	2.00E-02	1.00E-03
Aliphatic >C10-C12	2	2	1.69E-04	3.00E-02	7.00E-02	3.00E-03
Aliphatic >C12-C16	74	74	5.43E-03	0.00E+00	3.50E-01	1.60E-01
Aliphatic >C16-C21	290	290	2.13E-02	0.00E+00	3.40E-01	7.00E-01
Aliphatic >C21-C34	420	420	3.08E-02	0.00E+00	0.00E+00	0.00E+00
Aromatic >C8-C10	4	4	2.72E-04	9.02E-02	2.52E-03	1.00E-03
Aromatic >C10-C12	10	3	1.90E-04	2.25E-02	7.40E-03	1.00E-03
Aromatic >C12-C16	510	510	3.75E-02	0.00E+00	8.00E-02	7.00E-03
Aromatic >C16-C21	8900	8900	6.54E-01	0.00E+00	1.20E-01	8.00E-02
Aromatic >C21-C34	3400	3400	2.50E-01	0.00E+00	0.00E+00	4.60E-02
n-Hexane	0.0	0.0	0.00E+00	2.40E-02	0.00E+00	0.00E+00
Benzene	0.0		0.00E+00	2.50E-02	2.90E-04	0.00E+00
Toluene	0.0		0.00E+00	1.20E-01	1.80E-03	0.00E+00
Ethylbenzene	0.0		0.00E+00	2.00E-02	6.80E-04	0.00E+00
Total Xylenes	0.0		0.00E+00	1.10E-01	5.00E-03	0.00E+00
1,2,4-trimethylbenzene	0.0		0.00E+00	3.00E-02	0.00E+00	0.00E+00
1,3,5-trimethylbenzene	0.0		0.00E+00	9.80E-03	1.80E-03	0.00E+00
Naphthalene	7.4	7.4	5.44E-04	2.50E-03	2.60E-03	0.00E+00
Total	13623	13616	1.00	1.00	1.00	1.00

OPTION 1:	(1) Enter TPH data (mg/kg or ppm) into the cell on the right.	
Estimate TPH Fractions	(2) Enter BTEX, TMB, and naphthalene data in the "Raw Data" column above.	Gasoline Estimate
	(3) Use one of the buttons at the right to identify the predominant product.	Diesel Estimate
OR		
OPTION 2:	(1) Enter TPH fraction and constituent data in the "Raw Data" column above.	Gasoline Fractions
Use VPH and EPH Results	(2) Use one of the buttons at the right to identify the predominant product.	Non-Gas Fractions

For references, please refer to Risk-Based Decision Making for the Remediation of Petroleum-Contaminated Sites (DEQ, 2003).

#### Risk-Based Concentrations

Calculate		RBCsw				
RBCs	Fuel Fraction	Residential	Urban Residential	Occupationa		
Generic		(mg/kg)	(mg/kg)	(mg/kg)		
Gasoline	Aliphatic C5-C6	3.2E-05	3.2E-05	7.6E-06		
Generic Diesel or	Aliphatic >C6-C8	3.6E-05	3.6E-05	8.6E-06		
Heating Oil	Aliphatic >C8-C10	7.5E-06	7.5E-06	1.8E-06		
Generic Mineral	Aliphatic >C10-C12	9.2E-07	9.2E-07	2.2E-07		
Insulating Oil	Aliphatic >C12-C16	1.9E-07	1.9E-07	4.8E-08		
Site-Specific	Aliphatic >C16-C21	6.1E-12	6.1E-12	1.5E-12		
Data	Aliphatic >C21-C34	3.6E-17	3.6E-17	9.0E-18		
- "	Aromatic >C8-C10	2.5E-20	2.5E-20	6.0E-21		
Progress of	Aromatic >C10-C12	7.1E-04	7.1E-04	1.7E-04		
Calculations	Aromatic >C12-C16	2.8E-02	2.8E-02	6.8E-03		
RBCa	Aromatic >C16-C21	4.4E-02	4.4E-02	1.0E-02		
RBCtw	Aromatic >C21-C34	1.6E-05	1.6E-05	4.0E-06		
RBCss	n-Hexane	0.0E+00	0.0E+00	0.0E+00		
RBCso	Benzene	0.0E+00	0.0E+00	0.0E+00		
RBCsi	Toluene	0.0E+00	0.0E+00	0.0E+00		
RBCsw	Ethylbenzene	0.0E+00	0.0E+00	0.0E+00		
RBCwo	Total Xylenes	0.0E+00	0.0E+00	0.0E+00		
RBCwi	1,2,4-trimethylbenzene	0.0E+00	0.0E+00	0.0E+00		
RBCwe	1,3,5-trimethylbenzene	0.0E+00	0.0E+00	0.0E+00		
	Naphthalene	7.2E-02	7.2E-02	1.7E-02		
Done	TPH RBC* →	>MAX	>MAX	>MAX		
DEQ	Generic Gasoline	31	31	130		
Default	Generic Diesel / Heating Oil	9,500	9,500	>MAX		
TPH RBCs	Generic Mineral Insulating Oil	>MAX	>MAX	>MAX		

<sup>&</sup>quot; The TPH RBCs are based on a Hazard Index = 1 for the sum of all aliphatic fractions, aromatic fractions, and constituents present in the product.

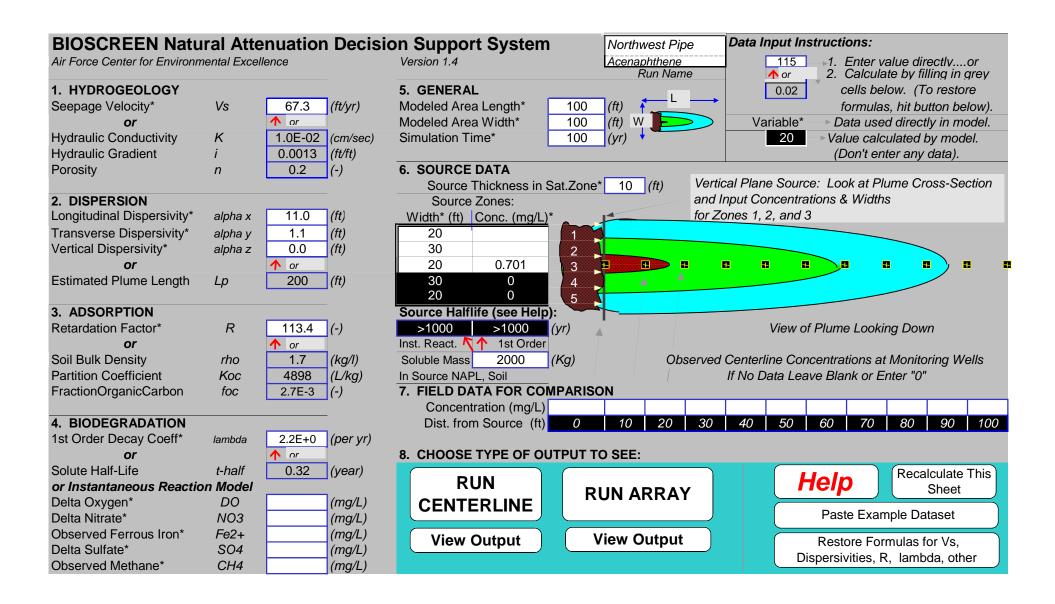
The data in the gray area of the frain table above represent the following:

- 1. For Air and Groundwater RBCs the data are the RBCs for the specified fuel fraction or constituent.
- 2. For Soil RBCs the data are the hazard quotients for the specified fuel fraction or constituent.

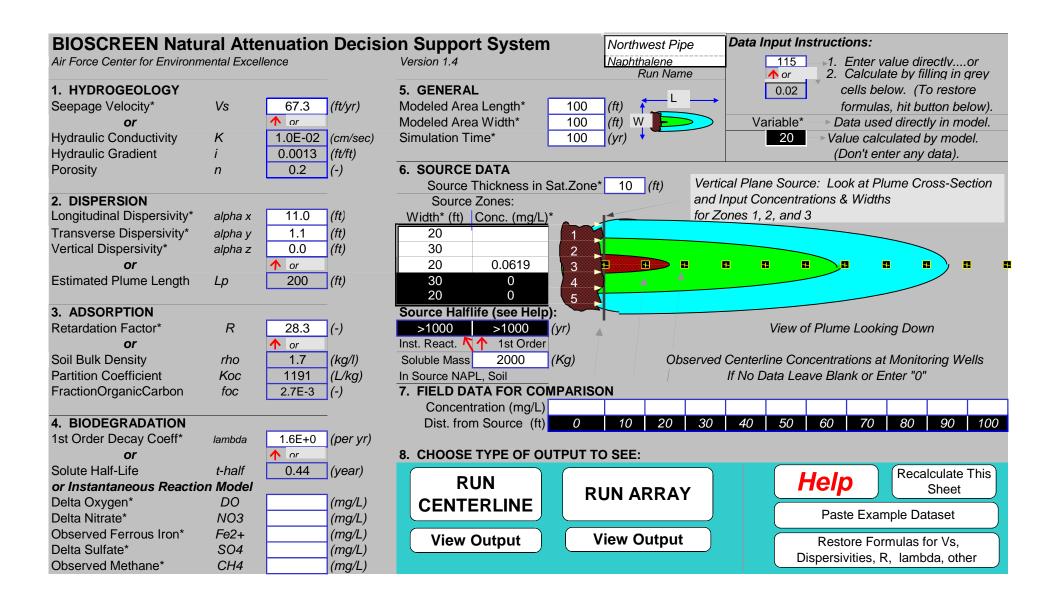
For notes and references, please refer to Risk-Based Decision Making for the Remediation of Petroleum-Contaminated Sites (DEQ. 2003).

## **Attachment 4**

**BIOSCREEN Base Case** 

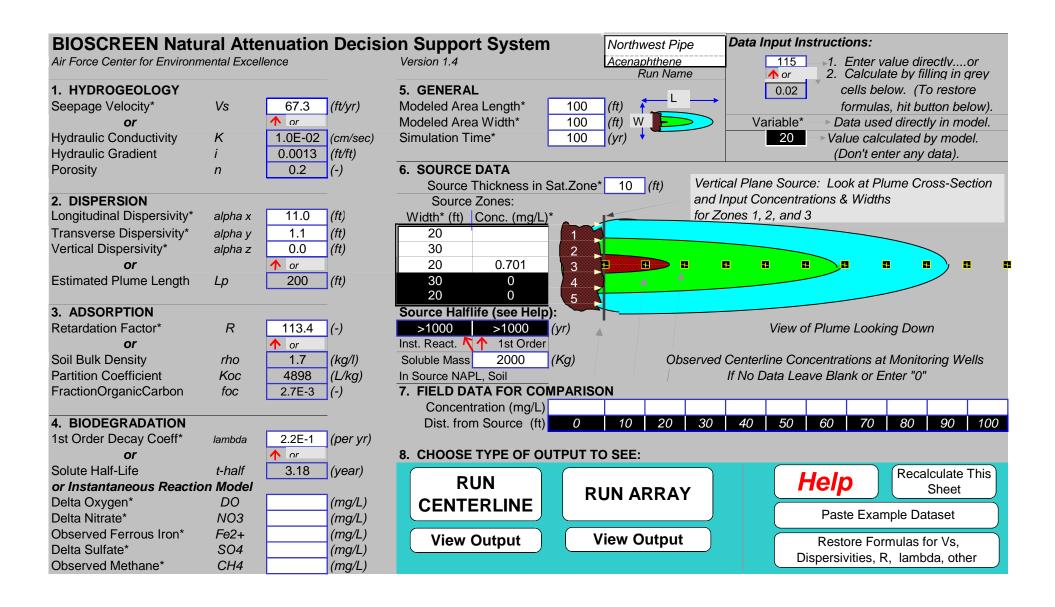


#### DISSOLVED HYDROCARBON CONCENTRATION ALONG PLUME CENTERLINE (mg/L at Z=0) Distance from Source (ft) **TYPE OF MODEL** 10 20 30 60 70 80 90 100 0 40 50 **No Degradation** 0.699 0.618 0.523 0.433 0.351 0.278 0.212 0.156 0.109 0.072 0.046 1st Order Decay 0.699 0.003 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 Inst. Reaction 0.699 0.618 0.523 0.433 0.351 0.278 0.212 0.156 0.109 0.072 0.046 Field Data from Site **─** 1st Order Decay Instantaneous Reaction ■No Degradation Field Data from Site 0.800 0.700 Concentration 0.600 9.500 9.400 0.300 0.200 0.100 0.000 20 80 100 120 0 Distance From Source (ft) Time: Calculate Return to 100 Years Recalculate This Sheet **Animation** Input

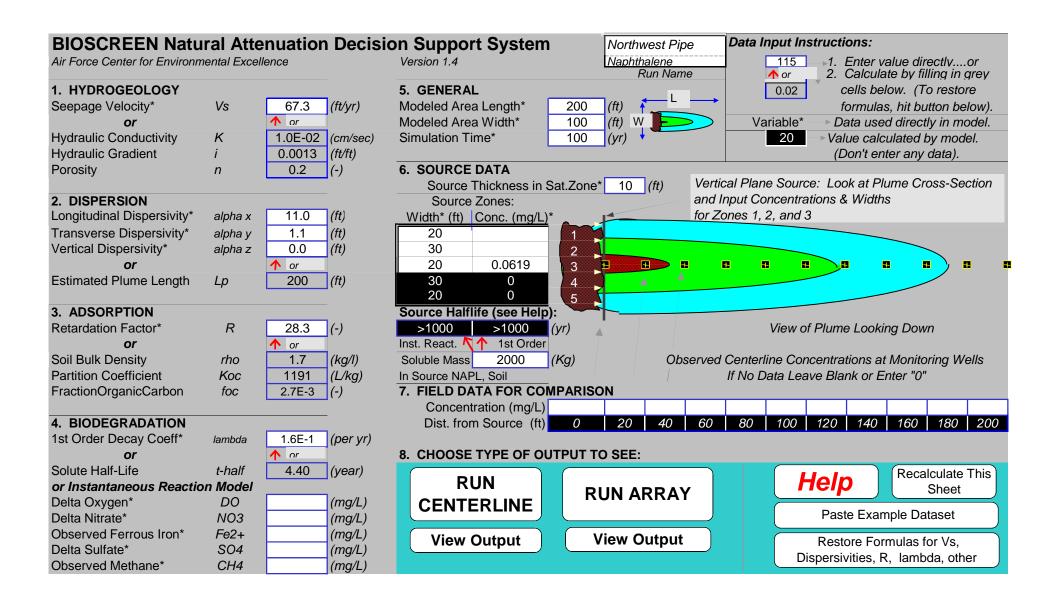


#### DISSOLVED HYDROCARBON CONCENTRATION ALONG PLUME CENTERLINE (mg/L at Z=0) Distance from Source (ft) **TYPE OF MODEL** 10 30 60 70 80 90 100 0 20 40 50 **No Degradation** 0.062 0.060 0.054 0.048 0.044 0.041 0.038 0.035 0.033 0.032 0.030 1st Order Decay 0.062 0.008 0.001 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 Inst. Reaction 0.062 0.060 0.054 0.048 0.044 0.041 0.038 0.035 0.033 0.032 0.030 Field Data from Site **─** 1st Order Decay Instantaneous Reaction **──** No Degradation Field Data from Site 0.1 0.1 Concentration 0.1 (mg).0 0.0 0.0 0.0 Distance From Source (ft) 0 20 80 100 120 Time: Replay Next Timestep Return to 100 Years Recalculate This Sheet **Animation** Prev Timestep Input

BIOSCREEN Sensitivity Run High Degradation Half-life (slower degradation rate)

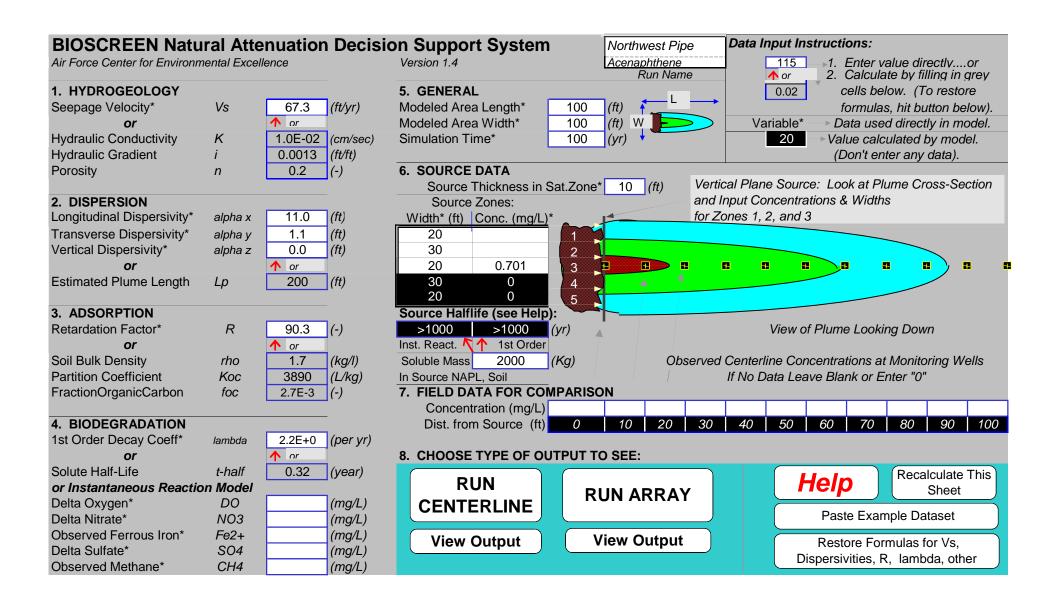


#### DISSOLVED HYDROCARBON CONCENTRATION ALONG PLUME CENTERLINE (mg/L at Z=0) Distance from Source (ft) **TYPE OF MODEL** 10 20 30 60 70 80 90 100 0 40 50 **No Degradation** 0.699 0.618 0.523 0.433 0.351 0.278 0.212 0.156 0.109 0.072 0.046 1st Order Decay 0.699 0.162 0.035 0.008 0.002 0.000 0.000 0.000 0.000 0.000 0.000 Inst. Reaction 0.699 0.618 0.523 0.433 0.351 0.278 0.212 0.156 0.109 0.072 0.046 Field Data from Site **─** 1st Order Decay Instantaneous Reaction ■No Degradation Field Data from Site 0.800 0.700 Concentration 0.600 9.500 9.400 0.300 0.200 0.100 0.000 20 80 100 120 0 Distance From Source (ft) Time: Calculate Return to 100 Years Recalculate This Sheet **Animation** Input

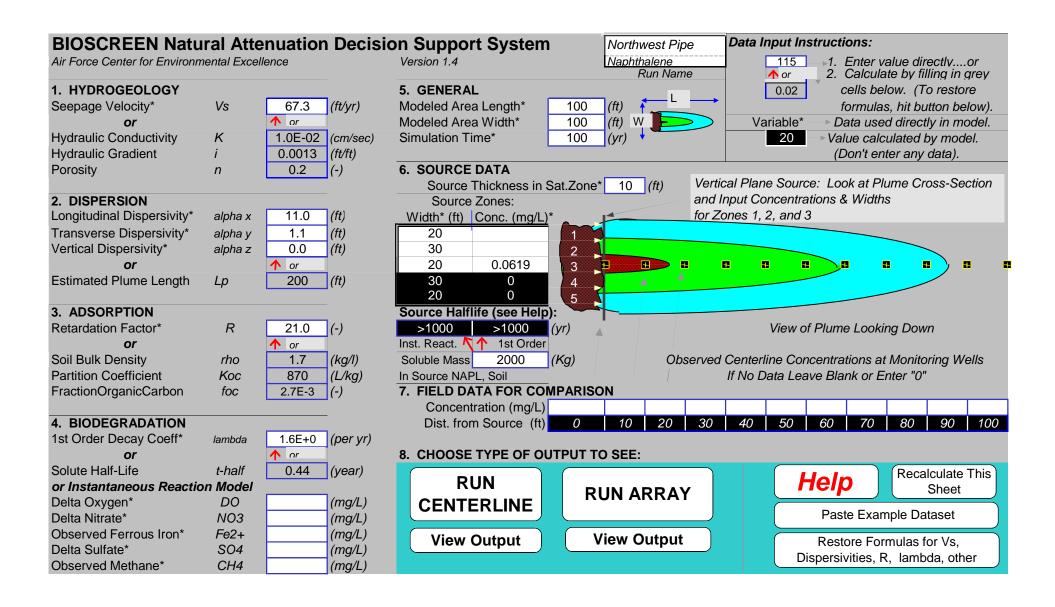


#### DISSOLVED HYDROCARBON CONCENTRATION ALONG PLUME CENTERLINE (mg/L at Z=0) Distance from Source (ft) **TYPE OF MODEL** 20 40 60 100 120 140 160 180 200 0 80 **No Degradation** 0.062 0.054 0.044 0.038 0.033 0.030 0.027 0.024 0.022 0.019 0.016 1st Order Decay 0.000 0.062 0.022 0.007 0.003 0.001 0.000 0.000 0.000 0.000 0.000 Inst. Reaction 0.062 0.054 0.044 0.038 0.033 0.030 0.027 0.024 0.022 0.019 0.016 Field Data from Site → 1st Order Decay Instantaneous Reaction ■No Degradation Field Data from Site 0.070 0.060 Concentration 0.050 (1)0.040 (1)0.030 0.020 0.010 0.000 50 100 150 200 250 0 **Distance From Source (ft)** Time: Calculate Return to 100 Years Recalculate This Sheet **Animation** Input

BIOSCREEN Sensitivity Run Low Organic Carbon Partition Coefficient (faster migration)

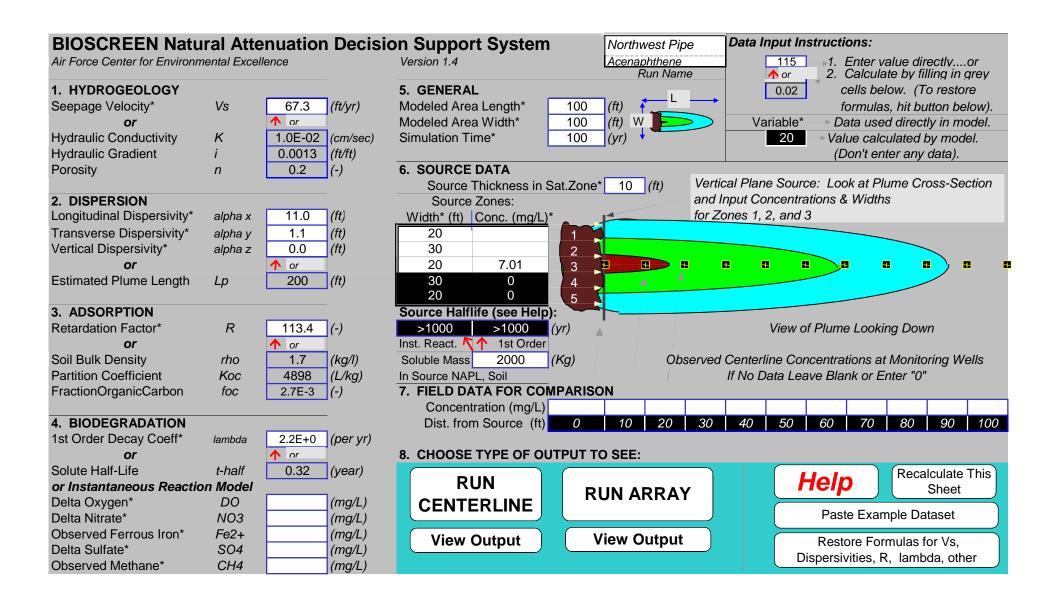


#### DISSOLVED HYDROCARBON CONCENTRATION ALONG PLUME CENTERLINE (mg/L at Z=0) Distance from Source (ft) **TYPE OF MODEL** 10 20 30 60 70 80 90 100 0 40 50 **No Degradation** 0.699 0.638 0.553 0.472 0.401 0.336 0.276 0.221 0.171 0.128 0.093 1st Order Decay 0.699 0.006 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 Inst. Reaction 0.699 0.638 0.553 0.472 0.401 0.336 0.276 0.221 0.171 0.128 0.093 Field Data from Site **─** 1st Order Decay Instantaneous Reaction ■No Degradation Field Data from Site 0.800 0.700 Concentration 0.600 9.500 9.400 0.300 0.200 0.100 0.000 20 Distance From Source (ft) 80 100 120 0 Time: Calculate Return to 100 Years Recalculate This Sheet **Animation** Input

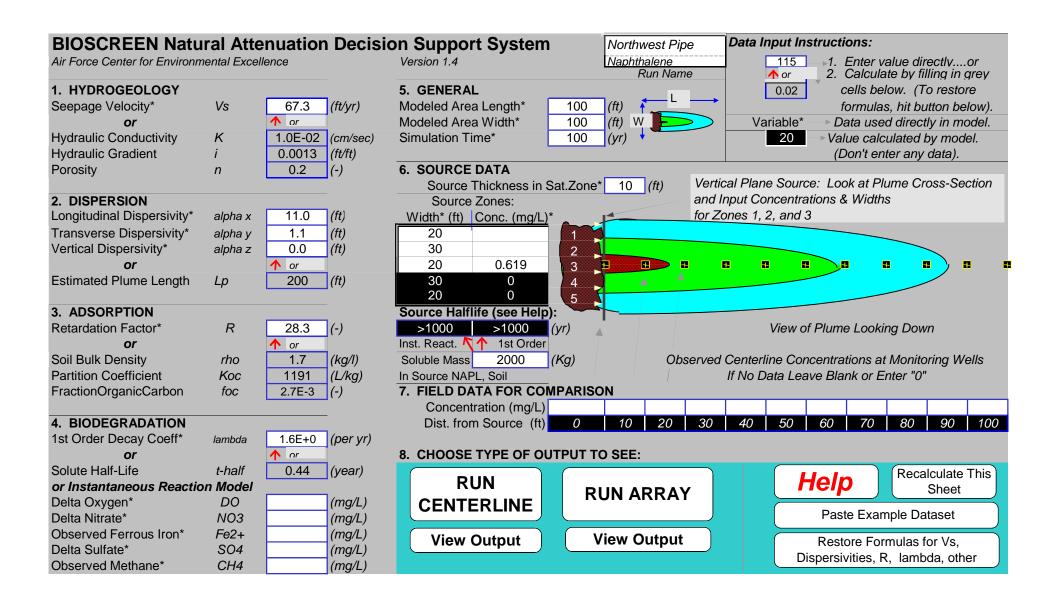


#### DISSOLVED HYDROCARBON CONCENTRATION ALONG PLUME CENTERLINE (mg/L at Z=0) Distance from Source (ft) **TYPE OF MODEL** 0 10 20 30 60 70 80 90 100 40 50 **No Degradation** 0.062 0.060 0.054 0.048 0.044 0.041 0.038 0.036 0.034 0.032 0.031 1st Order Decay 0.062 0.011 0.002 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 Inst. Reaction 0.062 0.060 0.054 0.048 0.044 0.041 0.038 0.036 0.034 0.032 0.031 Field Data from Site **─** 1st Order Decay Instantaneous Reaction ■No Degradation Field Data from Site 0.070 0.060 Concentration 0.050 (1)0.040 (1)0.030 0.020 0.010 0.000 100 20 Distance From Source (ft) 80 120 0 Time: Calculate Return to 100 Years Recalculate This Sheet **Animation** Input

BIOSCREEN Sensitivity Run Elevated Concentration (more potent source area)



#### DISSOLVED HYDROCARBON CONCENTRATION ALONG PLUME CENTERLINE (mg/L at Z=0) Distance from Source (ft) **TYPE OF MODEL** 10 20 30 60 70 80 90 100 0 40 50 **No Degradation** 6.825 6.056 5.149 4.275 3.484 2.767 2.123 1.557 1.090 0.725 0.456 1st Order Decay 6.825 0.032 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 Inst. Reaction 6.825 6.056 5.149 4.275 3.484 2.767 2.123 1.557 1.090 0.725 0.456 Field Data from Site **─** 1st Order Decay Instantaneous Reaction ■No Degradation Field Data from Site 8.000 7.000 6.000 Concentration 5.000 \$4.000 3.000 2.000 1.000 0.000 20 80 100 120 0 Distance From Source (ft) Time: Calculate Return to 100 Years Recalculate This Sheet **Animation** Input



#### DISSOLVED HYDROCARBON CONCENTRATION ALONG PLUME CENTERLINE (mg/L at Z=0) Distance from Source (ft) **TYPE OF MODEL** 0 10 20 30 60 70 80 90 100 40 50 **No Degradation** 0.618 0.597 0.535 0.481 0.439 0.405 0.377 0.354 0.334 0.316 0.300 1st Order Decay 0.618 0.078 0.009 0.001 0.000 0.000 0.000 0.000 0.000 0.000 0.000 Inst. Reaction 0.618 0.597 0.535 0.481 0.439 0.405 0.377 0.354 0.334 0.316 0.300 Field Data from Site **─** 1st Order Decay Instantaneous Reaction ■No Degradation Field Data from Site 0.700 0.600 Concentration 0.500 (1)0.400 (1)0.300 0.200 0.100 0.000 20 80 100 120 0 Distance From Source (ft) Time: Calculate Return to 100 Years Recalculate This Sheet **Animation** Input